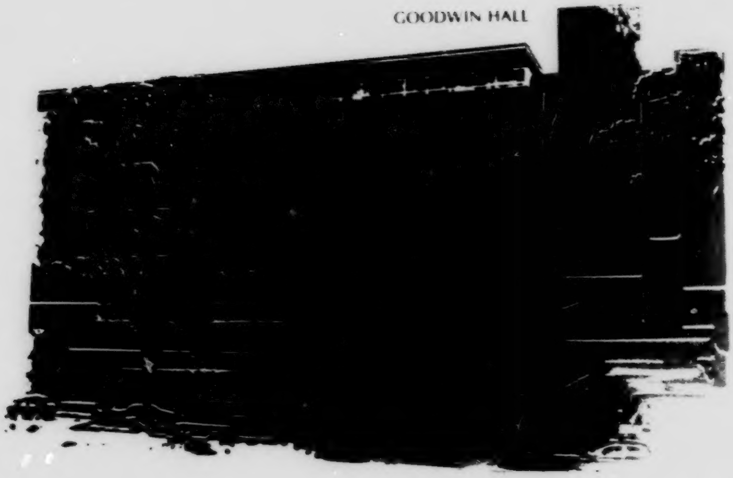
Final Report on

GOLD AND SILVER ELUTION FROM CARBON LOADED IN THIOUREA LEACH SOLUTION

DSS Contract No. 23440-0-9154/01-SS

March 31, 1992

W.T. Yen



MINING ENGINEERING
QUEEN'S UNIVERSITY at kingston, ontario, canada

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EXECUTIVE SUMMARY

Thiourea is an alternative to cyanide for leaching gold and silver from ore. It offers the advantage of higher leaching rates and less environmental sensitivity. Dissolved gold-thiourea complex can be easily recovered from the solution by activated carbon. Difficulties are encountered in the desorption of gold from the carbon. The objective of this research program is to study the gold and silver recovery from thiourea leach solution by carbon adsorption, carbon elution and carbon regeneration.

Ore samples of Lac Minerals are used for column leaching with thiourea at Mineral Sciences Laboratories, CANMET. The pregnant solutions were used for carbon adsorption and desorption tests at Mining Engineering Department, Queen's University. The carbon regeneration test work was conducted on the eluted carbons.

About 30 litres pregnant solution assayed 0.5 mg/L Au was passed through an adsorption column packed with 7 - 10 gram activated carbon, Calgon GRC 6x16, at 2 - 3 bed volume per hour. The gold adsorption percent was higher than 90% at initial 1000 bed volume. The gold adsorption was gradually reduced to 50% as 2000 bed volume pregnant solution passed through the column. The gold loading was 1 - 2 mg/g Au and stayed a straight line relationship. If a higher grade pregnant solution is used for carbon adsorption, the gold loading will much higher.

To prepare carbon desorption test sample, gold powder was dissolved in the column pregnant solution with thiourea. The carbon was loaded up to 5 - 10 mg/g gold for all elution tests. The stripping solution used in this study was mainly acidic thiourea organic solution. Five organic solvents, acetone, acetonitrile, butanol, diethyl ether and ethanol, were added to sulphuric acid-thiourea solution. The variables include the concentrations of thiourea, sulphuric acid, organic solvents and solution temperature. The results indicate the effect of thiourea and sulphuric acid concentrations on the carbon desorption was not very sensitive. The type and concentration of organic solvent were the most important factor in the carbon desorption. The preference

for organic solvent is in the following order:

Butanol > Acetonitrile > Diethyl Ether > Ethanol > Acetone

Combining two different types of solvent in the stripping solution improved the desorption efficiency. By elevating the solution temperature to 40°C or slightly higher, the stripping efficiency and kinetics were also improved. The condition for the best desorption at room temperature (20°C) was 5% butanol, 50 - 100 g/L thiourea and 50 - 100 g/L sulphuric acid at 2 bed volume per hour. Within 60 bed volume elution, 90 - 92 % of gold was eluted leaving the carbon assayed 0.5 - 0.3 mg/g Au. The combination of butanol and acetonitrile or butanol and acetone increases the gold desorption to 93% leaving the carbon assayed 0.3 mg/g Au. Increasing the solution temperature to 60°C, 97 - 99.6 % of gold was stripped leaving the carbon assayed 0.14 - 0.02 mg/g Au. The composition of the best stripping solution was made up with 5% butanol, 50 - 100 g/L thiourea and 100 g/L sulphuric acid.

Non-organic stripping solutions, such as sodium sulphide, sodium thiosulphate, caustic cyanide, alkaline thiourea and alkaline thiourea, were also used in the late period of this investigation for carbon desorption test. The desorption efficiency for those conditions depends mainly on the solution concentration and temperature. The condition for the best desorption result was 1 or 2 moles sodium sulphide at room temperature with elution rate 2 bed volume per hour. More than 99% of gold was desorbed in 36 bed volume leaving the carbon assayed less than 0.1 mg/g Au. If the solution concentration is lower than 0.5 M, the solution temperature has to raise to 80°C or higher to produce the same results as the 1 or 2 M solution at ambient temperature.

The activity of the eluted carbon was diminished greatly in loading capacity. The carbon eluted with NaCN-NaOH and Na_2S solutions can be recycled three times before regeneration. The regeneration at 700° C - 800° C for 30 - 60 minutes could restor the carbon activity for re-use. The loading capacity was restored to 80% that of the fresh carbon. The rate of adsorption was restored to 100% or better than that of the fresh carbon.

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1, INTRODUCTION

Cyanidation is a standard process to extract fine gold and silver from ore. Due to the environmental problem of the effluent, thiourea leaching is one of the alternatives for the gold and silver extractions.

High reagent consumption and un-stability of thiourea prohibit the use of thiourea in the gold industrial for a long time. Several researches in last decades have greatly reduced the reagent consumption and render the thiourea leaching feasible for the gold recovery. The difficulty is to recover the gold from the pregnant solution.

Activated carbon is one of the best methods to recover gold from either cyanide or thiourea leach pregnant solution. Carbon-in-pulp or carbon-in-leach process was not used in the gold producing industry until the carbon stripping method - Zadra process - was developed. The composition of this stripping solution is high concentrations of sodium cyanide and sodium hydroxide. The main purpose of thiourea leaching in to avoid the toxic cyanide. Thus, gold and silver elution from carbon loaded in thiourea leach solution should use non-cyanide stripping solution. There are few researchers contributed these information.

Yen(1,2) has used a solution composed of 30% acetone, 100 g/L thiourea and 100 g/L sulphuric acid to strip 95% of gold at room temperature from the carbon leaving the residual carbon assayed 0.52 mg/g Au. The elution rate was 1.25 bed volume per hour and total elution volume was 30 bed volume. Schulze(3,4) used a solution composed 5% butanol and 10 g/L thiourea at pH 2 to elute 95% of gold from the carbon at 40^{0}C with 50 bed volume. The elution rate was 2 bed volume per hour. Other organic solvents, such as alcohols, esters, ethers, ketones, nitriles and amides, were also used under the condition of pH 1 - 3, 50 g/L thiourea and 20% organic solvent. Fleming$^{(5)}$ has tried solutions of sulphuric acid, hydrochloric acid, sodium hydroxide, ammonium thiocyanate, sodium cyanide, sodium sulphide and various mixture to elute carbon loaded with gold-thiourea complex. It was found that the most effective eluants are sodium cyanide in a water-ethanol solvent (35% - 70% ethanol) at 55^{0}C and 0.5 M sodium sulphide solution at 94^{0}C. Although the carbon elution efficiency is high, the gold recovery from the eluted solution by electrolysis may cause the oxidation of sulphide to polysulphide at the anode of the electrowinning cell. Pesic$^{(6)}$ reported that almost gold elution can be achieved at 50^{0}C, pH 8.5, and 50 g/L sodium thiosulphate after only 120 minutes.

In short, there are two possible routes to strip gold-thiourea complex from the carbon by using non-cyanide eluant:

(1) Acidic thiourea organic solution.

(2) Sodium sulphide and sodium thiosulphate solutions.

Main investigation target in the initial investigation stage was to study the acidic thiourea organic solvent system for eluting gold-thiourea complex from the carbon. Several organic solvents were used in the preliminary test. It was narrow down to five organic solvents for the whole test work, i.e., acetone, acetonitrile, butanol, diethyl ether and ethanol. The variables of the study include the concentrations of thiourea, sulphuric acid, organic solvents, solution temperature and the mixture of organic solvents.

In the final stage of this study, other type of eluants, such as sodium sulphide, sodium thiosulphate, sodium carbonate, caustic sodium cyanide and alkaline thiourea solutions, were used to compared the elution efficiency of the possible eluants.

The eluted carbons were finally selected for recycle and regneration test to evalaute the feasibility of re-using the activated carbon.

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(4) Schulze, R. (1989), Desorption of Thiourea-Noble Metal-Complexes from Activated Carbon and Recovery of the Noble Metals, Patent DE 3801340, Gold Bulletin and Gold Patent Digest, Volume 22, No.4, pp.110-111.

(5) Fleming, C.A. (1987), The Recovery of Gold from Thiourea and Thiocyanate Leach Solutions with Activated Carbon, Proceedings of the International Symposium on Gold Metallurgy, Winnipeg, Manitoba, Pergamon Press, pp. 259 - 277.

(6) Pesic, B. (1989), Recovery of Silver and Gold from Activated Carbon Loaded from Thiourea Solutions. Precious Metals 1989, Montreal, Quebec, International Precious Metals Institute, pp. 275 -286.

2, EXPERIMENTAL MATERIALS AND PROCEDURE

2.1, Experimental Materials:

The ore sample of Lac Minerals Inc. was used at Mineral Sciences Laboratories, CANMET for column leach test using thiourea as lixiviant. Eight pregnant solutions were collected for carbon adsorption and desorption test works. The solution assay is listed in Table I.

Table I, Chemical Analysis of Column Leach Solution

	CLS1	CLS2	CLS3	CLS4	TY-1	TY-2	TY-3	TY-4
TU	1.19	1.37	1.37	1.32	0.4	0.4	0.4	3.5
FA	0	0	2.70	2.32	1.7	0	1.2	6.1
pH	2.98	2.95	1.86	1.96	1.82	2.56	1.77	1.04
EMF	131	159	162	162	234	286	242	120
Au	0.59	0.40	0.46	0.54	0.39	0.29	0.25	35.4
Ag	0.12	0.08	0.09	0.07	0.28	0.22	0.25	2.46
Cu	1.95	2.65	2.75	2.20	2.32	2.43	2.69	6.55
Fe	5700	5630	4500	6540	3852	2680	3796	141

Note: TU & FA:- Thiourea & Free Acid, g/L
EMF:- mV
Au, Ag, Cu & Fe:- mg/L

For preparing gold pregnant solution, 95% pure gold precipitate supplied by BDH Chemicals was used. All other reagents, such as thiourea, ferric sulphate, sulphuric acid, acetone, acetonitrile, butanol, diethyl ether, ethanol, sodium hydroxide, sodium cyanide, sodium carbonate, sodium sulphide and sodium thiosulphate, are technical grade and also supplied by BDH Chemicals.

Calgon GRC-22, 6x16, donated by Calgon Carbon Corporation, was used for all adsorption and desorption test works.

2.2. Experimental Procedure:

2.2.1. Carbon Adsorption Test Procedure:

The adsorption test was conducted in a 25 ml burette packed with 7 - 10 grams activated carbon. A peristaltic pump was used to pass the pregnant solution from the bottom of the burette in a flow rate of 0.6 mL per minute or 2 - 3 bed volume per hour. The barren solution was collected from the top of burette and assayed for gold by lead boat technique.

To obtain the desired carbon loading, high gold concentration pregnant solution was prepared by dissolving the gold precipitate in the column pregnant solution which was readjusted the composition to 10 g/L thiourea, 0.5 g/L ferric iron and pH < 1. The fresh activated carbon was water washed and then contacted with the concentrated pregnant solution to a loading of 5 - 10 mg/g Au or 5 - 10 kg/tonne Au.

2.2.2. Carbon Desorption Test Procedure:

Carbon elution test was conducted by packing 10 grams loaded carbon in a 25 mL burette and eluting the stripping solution with a peristaltic pump at 2 bed volume per hour. The eluate was collected every hour for gold assay by Atomic Absorption Spectrophotometer. The eluted carbon was washed with the elution solution and water, dried and assayed for gold by combined technique of fire assay and Atomic Absorption Spectrophotometer. Most of solution temperature was conducted at ambient temperature (about 25^0C). The elevated solution temperature was controlled by an electrical heating pack wrapped around the elution column. The solution elution was terminated at the end of day and further continued in the morning of the second day. The eluant was freshly prepared every day.

The standard solution used in the Atomic Absorption Spectrophotometer determination was prepared by adding the standard gold solution into a matrix which contained the same composition of the eluant. The AA result was double checked with the lead boat - fire assay technique.

The variables chosen for the test work was based on the principle of semi-factorial design. The most significant conditions were repeated two or more times.

2.2.3. Carbon Regeneration Test Procedure:

The eluted carbons were selected for carbon activity and regeneration tests. The activity test was conducted to determined the K-value and R-value of the carbon. The K-value or carbon loading capacity is defined as the carbon loading in mg of gold per gram carbon at the equilibrium solution concentration of 1 mg/L Au. The R-value is the rate of gold adsorption onto carbon, which could be expressed either as the per cent of gold adsorbed onto carbon in one hour or as the time in minutes required for one unit carbon loading in one hour.

To prepare the sample for K- and R-values determination, carbon was soaked in a 3% HCl solution and boiled for 10 minutes. The acid solution was then decanted and the carbon washed with distilled water till the pH reached about 7. The carbon was dried at 105^0 C to a constant mass and cooled in a desiccator.

For K-value determination, accurately measure 0.20, 0.40, 0.60, 0.80 and 1.00 gram of the sample into a 1 litre bottle and add 200 ml of 100 mg/L Au standard gold thiourea complex solution to each bottle. Rotating the bottle on rolls at 46 rpm for 20 hours and assay gold for both equilibrium solution and the carbon. The gold loading capacity is calculated by Freundlich adsorption isotherm equation:

$$\log (X/M) = \log (KC)$$

where x is the mass of gold adsorbed on the carbon in mg.

M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate in mg/L.
K is the constant.

The (X/M) value at 1 mg/L Au equilibrium concentration determined from the isotherm plot is the K-value (carbon loading capacity).

For R-value determination, accurately measure 1.000 gram of carbon to a 2 litre bottle. One litre of 10 mg/L Au gold thiourea complex solution is added to the bottle and rotated on rolls at 46 rpm. 5 ml aliquot is withdrawn for gold assay after 0, 15, 30, 60, 75 and 90 minutes agitation. The R-value in per cent is calculated by following equation:

$$\text{R-value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold solution concentration and B is the gold solution concentration at time of 60 minutes adsorption.

The R-value in minutes per unit carbon loading is calculated from following equation:

$$t/(X/M) = (1/M)t + 1/R$$

Where t is the adsorption time in minutes and 1/R is the intercept of the plot t vs. t/(X/M). The R-value is the t/(X/M) value obtained at one hour adsorption.

To restore the activity of the eluted carbon, a horizontal furnace was used for carbon thermal regeneration test. The temperature of the furnace is controlled by the electrical elements. The horizontal quartz tube, 2" X 24" is used for mixing the carbon sample. After furnace reaches the desired temperature, carbon sample is placed in the centre of the horizontal rotating tube. The steam is injected through tube as required. The carbon is then cooled in air or quenched in the cool water.

3, EXPERIMENTAL RESULTS

3.1, Carbon Adsorption Test:

Column leach pregnant solutions, CLS2, CLS3 and CLS4, were used for carbon adsorption test.

Total 31,293 mL CLS4 solution was passed through 7. 0 grams activated carbon. Figure 1 shows the gold recovery from solution by the carbon. At initial 1,100 bed volume, more than 90% of gold is adsorbed on the carbon. The gold adsorption percentage decreases rapidly from 90% at 1,100 bed volume to 45% at 2,235 bed volume. However, the overall gold adsorption to 2,235 bed volume is 84%. Similar result is also obtained from solutions CLS2 and CLS3. Figure 1(a) shows the gold recovery from solution CLS3. Total 28,955 mL CLS3 solution was passed through 10 grams activated carbon. More than 95% of gold is recovered by carbon at initial 1,000 bed volume solution. The gold adsorption is drastically decreased to below 70% at 1,500 bed volume. The overall gold adsorption to 1,500 bed volume is more than 90%.

Figure 2 and 2(a) show the carbon loading and barren solution assay from eluted solutions CLS4 and CLS3 respectively. The relationship between carbon loading and number of adsorption solution bed volume is a straight line up to 2,000 bed volume. The trend of the straight line indicates that the carbon is still capable to adsorb more gold from the solution. The barren solution assay is below 0.005 mg/L Au at initial 250 adsorption bed volume. The gold value in the barren solution increases rapidly as more than 1,000 bed volume pregnant solution has been contacted with the activated carbon. Final carbon loadings from solutions CLS4 and CLS3 are 1.954 mg/g Au and 1.21 mg/g Au respectively.

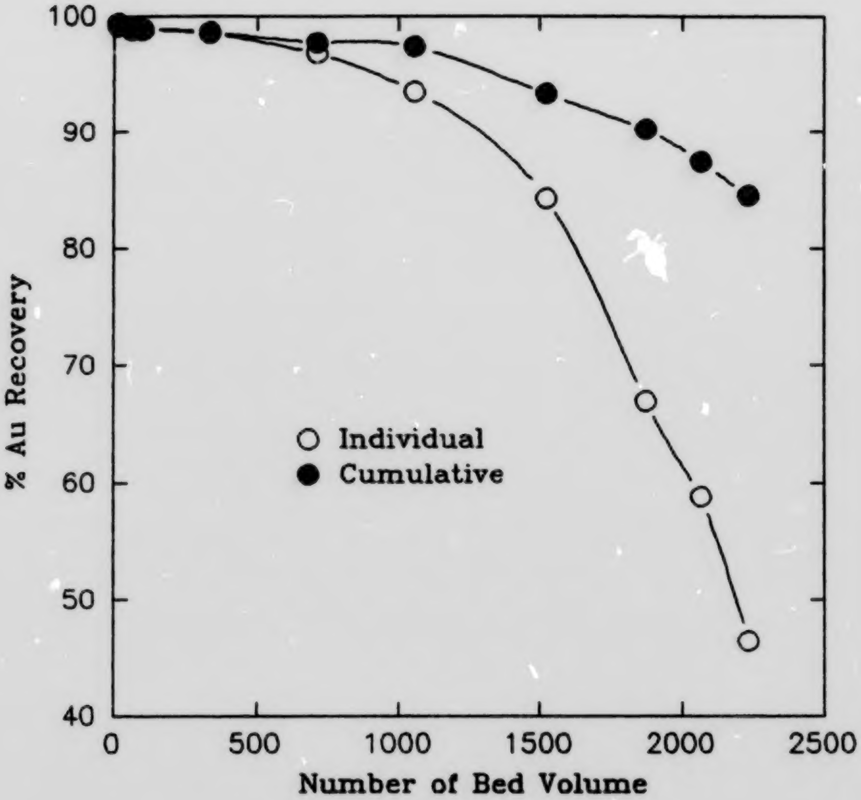


Figure 1, Gold Adsorbed on Carbon from Column Leach Solution

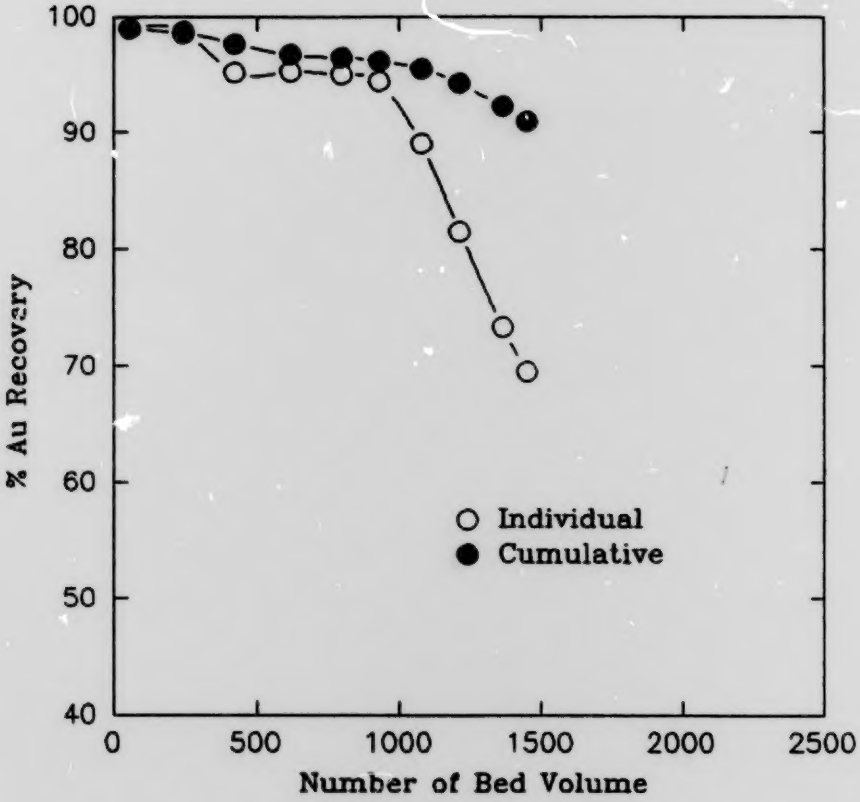


Figure 1(a). Gold Adsorbed on Carbon from Column Leach Solution

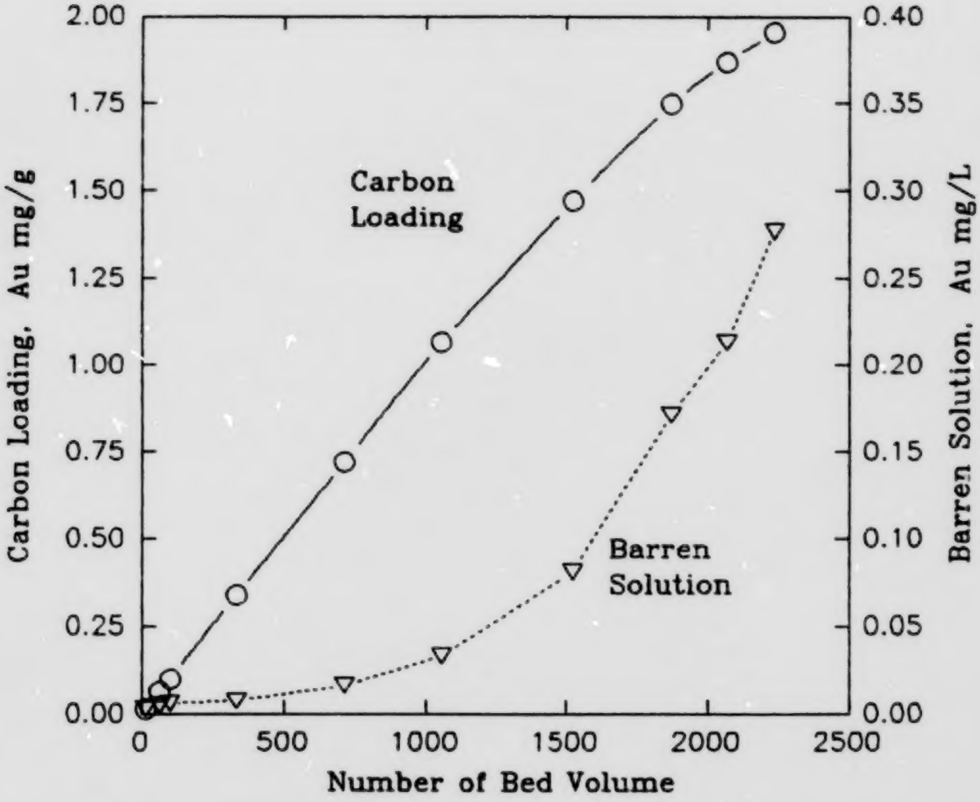


Figure 2, **Carbon Loading and Barren Solution from Column Leaching**

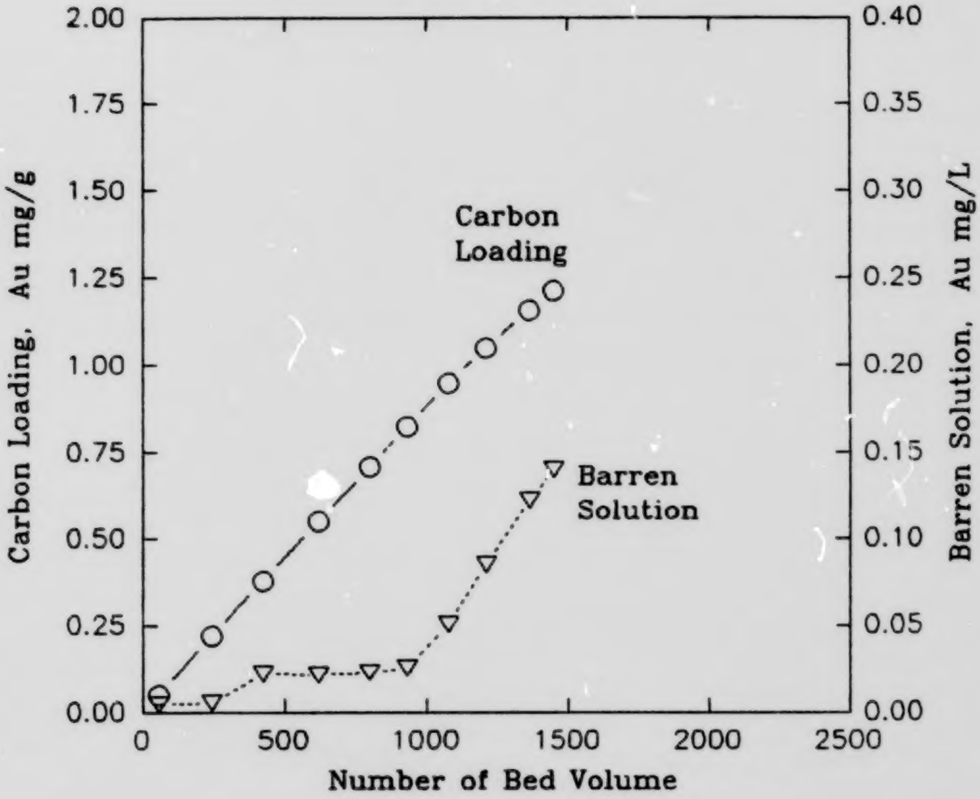


Figure 2(a). Carbon Loading and Barren Solution from Column Leaching

3.2. Carbon Desorption Test:

At exploratory stage, 50 g/L thiourea and 50 g/L sulphuric acid was used for carbon stripping. The percentage of gold desorption was less than 3% in 20 bed volume elution. Even the concentrations of both thiourea and sulphuric acid were increased to 100 g/L, the gold desorption percent remained the same. When the solution temperature increased, the gold desorption improved slightly. The significant improvement in the gold desorption was when the organic solvents were added in the acidic thiourea solution. Several different types of organic solvents were tried, we finally narrowed down five organic solvents: acetone, acetonitrile, butanol, diethyl ether and ethanol. The variables of the investigation include the concentrations of organic solvent, thiourea, sulphuric acid and solution temperature. In addition, both sodium sulphide and sodium thiosulphate solutions were also used for carbon stripping test. Results are shown in the following sections.

3.2.1, Elution with Acidic Thiourea Acetone

3.2.1.1, Effect of Acetone Concentration: The basic composition of the stripping solution composes of 50 g/L thiourea and 50 g/L sulphuric acid. The acetone concentration varies from 20% to 50%. Figure 3 shows the effect of acetone concentration on the % gold eluted from carbon. With 20% acetone in the solution, less than 10% of gold is desorbed in 50 bed volume elution. As acetone concentration increases to 40% and 50%, the gold desorption increases to 80% and 90% respectively at 50 bed volume. The residual carbon assays are less than 0.8 mg/g Au. Figure 4 shows the assay profile of the eluted solution under the same conditions. With 50% acetone in the solution, the solution assay from the initial 5 bed volumes are higher than 100 mg/L Au. The solution assay is less than 75 mg/L Au from other conditions.

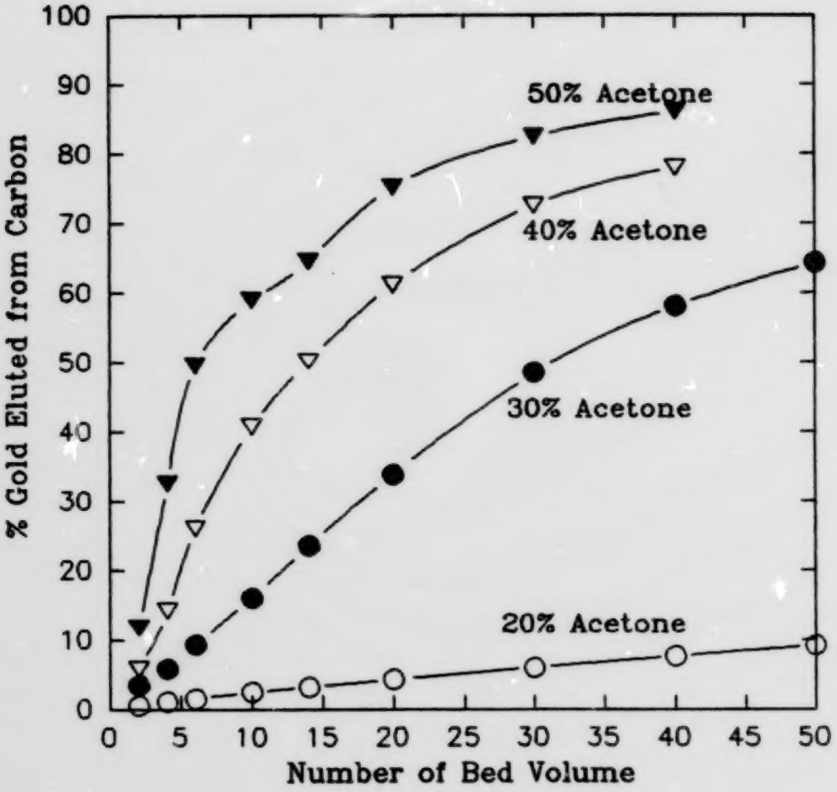


Figure 3. Effect of Acetone Concentration on Carbon Elution

50 g/L Thiourea & 50 g/L H_2SO_4

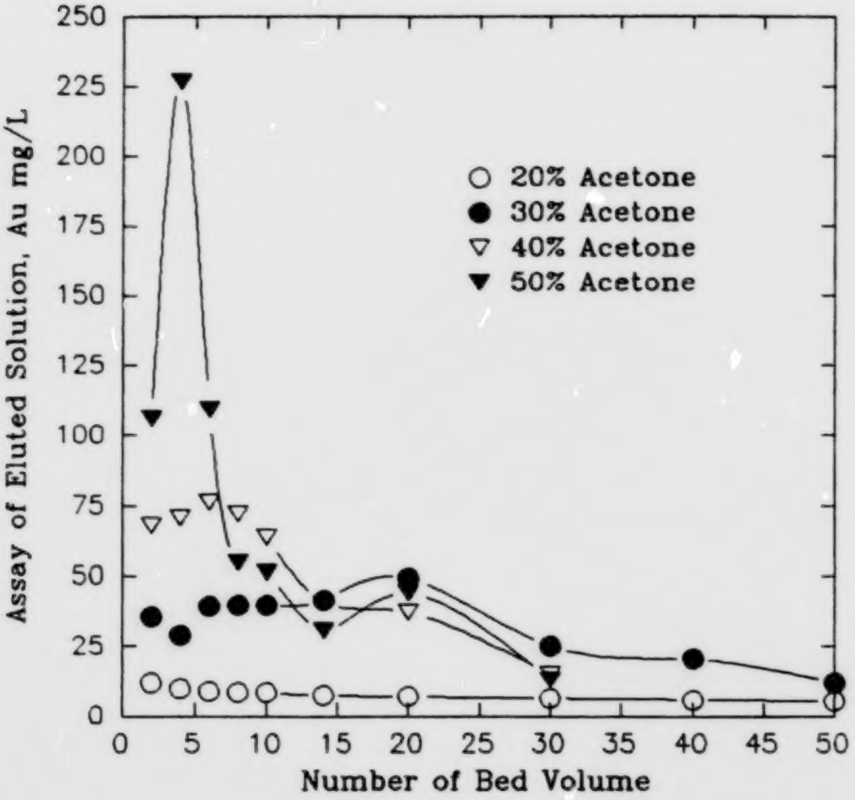


Figure 4. Effect of Acetone Concentration on Solution Eluted from Carbon
50 G/L Thiourea & 50 g/L H_2SO_4

3.2.1.2, Effect of Thiourea and Acid Concentrations: The acetone concentration is 30% or 40%. Both thiourea and sulphuric acid concentrations varies from 35 g/L to 100 g/L. Figure 5 shows the effect of thiourea and sulphuric acid concentrations on gold eluted from carbon. With 30% acetone in the solution, 37% gold is eluted by 50 bed volume of 35 g/L thiourea and 35 g/L sulphuric acid solution and 65% gold is eluted by 50 bed volume of 50 g/L thiourea and 50% sulphuric acid solution. Both thiourea and sulphuric acid concentration are very sensitive to the carbon desorption.

With 40% acetone in the solution, 76% gold is eluted by 50 bed volume of 35 g/L thiourea and 35 g/L sulphuric acid solution and 90% gold is eluted by 50 bed volume of 100 g/L thiourea and 100 g/L sulphuric acid solution. The gold desorption does increase with the concentration of thiourea and sulphuric acid but sensitivity is low. The best residual carbon assay is 0.58 mg/g Au.

Figure 6 shows the assay profile of the eluted solution under the same elution conditions. With solution contained 100 g/L thiourea, 100 g/L sulphuric acid and 40% acetone, the elution solution assay at the initial 10 bed volume is higher than 100 mg/L Au. The highest solution assay is 237 mg/L Au. The solution assay from other conditions is below 100 mg/L Au.

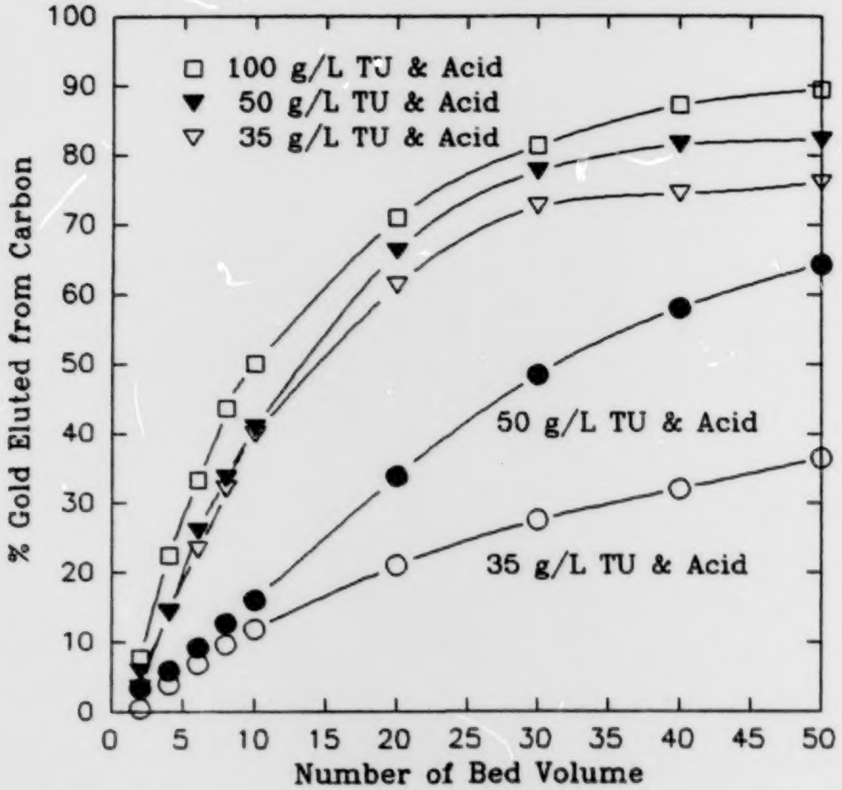


Figure 5, Effects of Thiourea (TU) and H_2SO_4 (Acid Concentration on Carbon Elution

○ & ● 30% Acetone

▽ ▼ & □ 40% Acetone

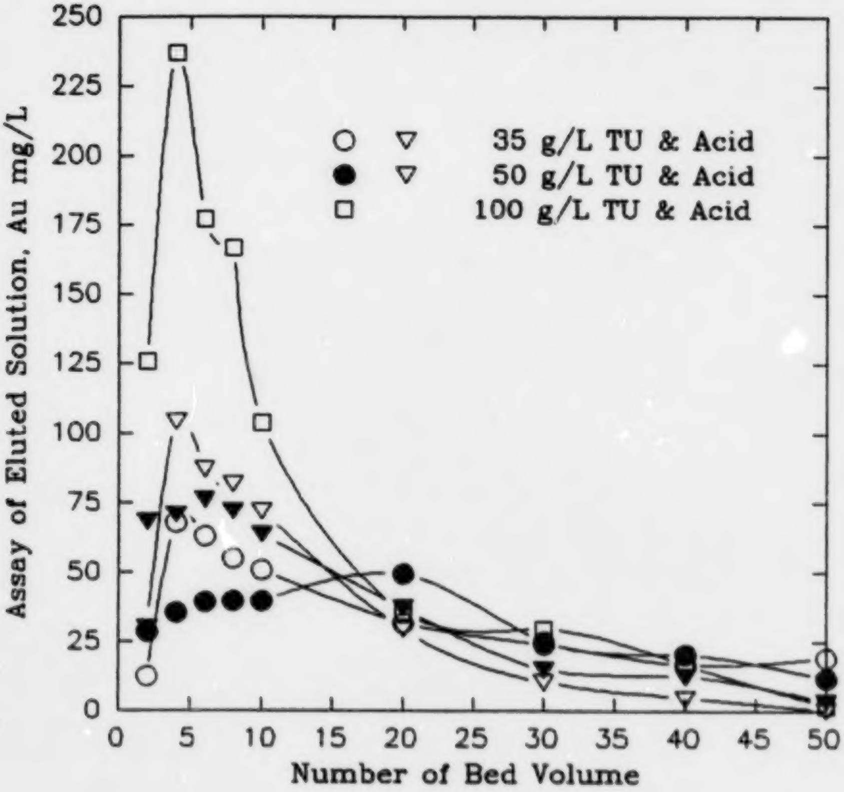


Figure 6. Effects of Thiourea (TU) and H_2SO_4 (Acid) Concentration on Solution Eluted from Carbon

○ & ● 30% Acetone

▽ ▼ & □ 40% Acetone

3.2.2, Elution with Acidic Thiourea Acetonitrile

3.2.2.1, Effect of Acetonitrile Concentration: The basic solution composition is 50 g/L thiourea and 50 g/L sulphuric acid. The concentration of acetonitrile varies from 5% to 50%. Figure 7 shows the effect of acetonitrile concentration on gold eluted from carbon. With acetonitrile concentration less than 10%, the gold elution by 40 bed volume solution is less than 10%. As the acetonitrile concentration is more than 20%, the gold elution percent increases rapidly.

With 20% acetonitrile in the solution, 80% gold is eluted by 60 bed volume solution. Under similar conditions, 90% and 96% gold are eluted by 30% and 50% acetonitrile solutions respectively. The best residual carbon assay is 0.21 mg/g Au.

Figure 8 shows the assay profile of the eluted solution under the same conditions. The solution assay is less than 25 mg/L Au from the elution solution contained 10% acetonitrile. With the solution contained 20% acetonitrile or more, the solution assay is higher than 100 mg/L Au at the initial 10 bed volume elution. With solution contained 50% acetonitrile, the highest solution assay is 275 mg/L Au.

3.2.2.2, Effects of Thiourea and Sulphuric Acid Concentrations: The basic composition of the solution contains 10% acetonitrile. The concentration of thiourea varies from 15 g/L to 75 g/L and the sulphuric acid concentration varies from 50 g/L to 100 g/L. Result of Table II indicates that the concentrations of both thiourea and sulphuric acid have not much effect on gold elution.

If the acetonitrile concentration is higher than 20%, the effects of thiourea and sulphuric acid concentrations on the gold elution may be improved.

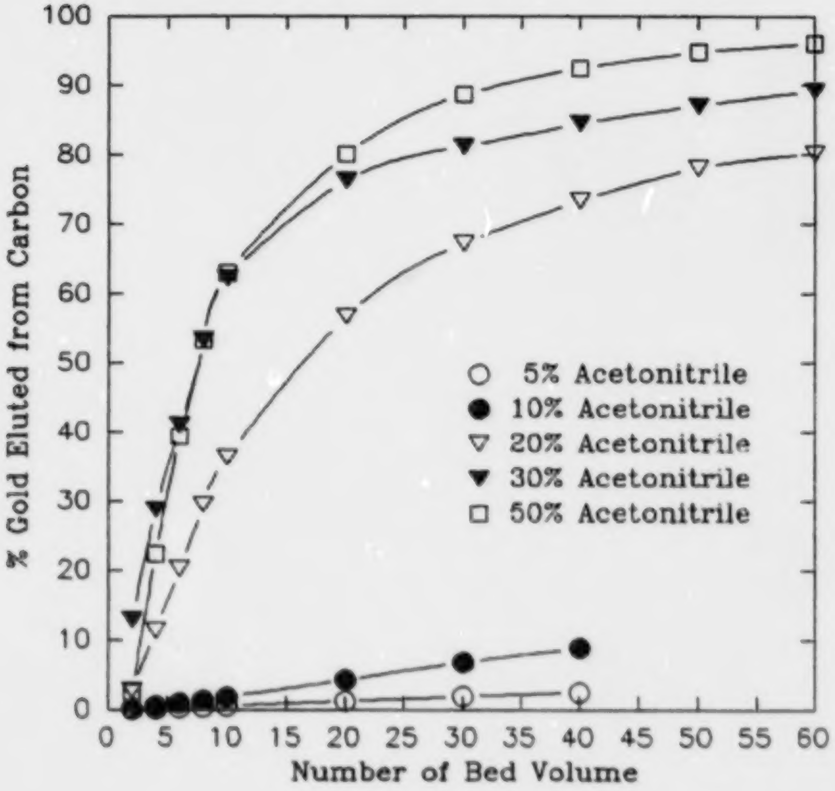


Figure 7, Effect of Acetonitrile Concentration on Carbon Elution

50 g/L Thiourea & 50 g/L H_2SO_4

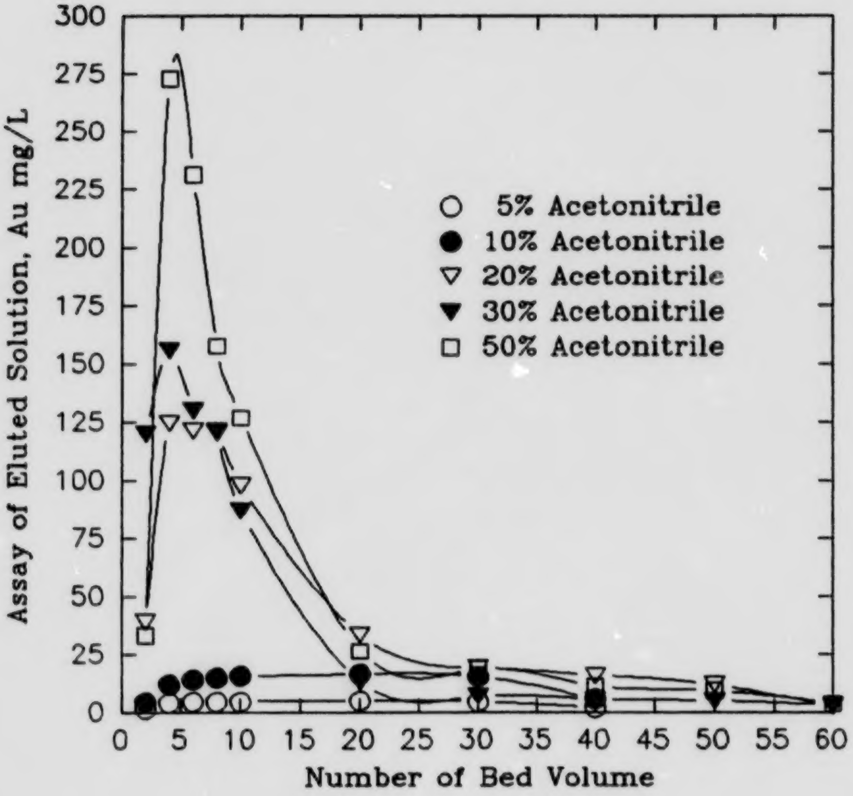


Figure 8, Effect of Acetonitrile Concentration on Solution Eluted from Carbon

50 g/L Thiourea & 50 g/L H_2SO_4

Table II, Effects of Thiourea & H_2SO_4 on Au Elution Using 10 g/L acetonitrile

Test No.	TU g/L	Acid g/L	No. B.V.	% Au Extra'tn	Final Carbon,mg/g	Head mg/g Au
16	15	50	40	9.35	3.84	4.23
11	25	50	34	20.5	11.02	13.87
9	50	50	38	8.8	12.18	13.36
14	75	50	38	12.33	3.67	4.18
44	50	100	38	5.2	4.48	4.73

3.2.3, Elution with Acidic Thiourea Butanol

The solubility of butanol in aqueous solution is less than 10%. Therefore the standard butanol concentration used in this investigation is 5%. If higher concentration of butanol is required, other type of organic solvent is mixed with butanol. Effects of thiourea and sulphuric acid concentration, solution temperature and organic combination on carbon elution are shown bellows.

3.2.3.1, Effect of Thiourea Concentration: The basic solution composition is 5% butanol and 50 g/L sulphuric acid. The thiourea concentration varies from 15 g/L to 75 g/L. Figure 9 shows the effect of thiourea concentration on gold eluted from carbon is not very sensitive. The difference between the gold elution with 15 g/L thiourea and 75 g/L thiourea is only 5%. About 85% gold is eluted by 50 bed volume 15 g/L thiourea solution and 90% gold is eluted by 75 g/L thiourea solution of same bed volume. The residual carbon assay under these three testing conditions are below 0.47 mg/g Au. The best residual carbon assay is 0.36 mg/g Au by using 75 g/L thiourea. Figure 10 shows the assay profile of the eluted solution under the same conditions. The highest solution assay is between 100 mg/L Au and 150 mg/L Au.

3.2.3.2, Effect of Acid Concentration: The basic solution composition is 5% butanol and 30 g/L thiourea. The sulphuric acid concentration varies from 30 g/L to 75 g/L H_2SO_4. Results of Figures 11 and 12 also indicate that the effect of sulphuric concentration on gold elution is not very sensitive under the testing conditions. The difference of gold elution by using 30 g/L sulphuric acid and 75 g/L sulphuric acid is about 5% only. The solution assay profile also the same as in section 3.2.3.1.

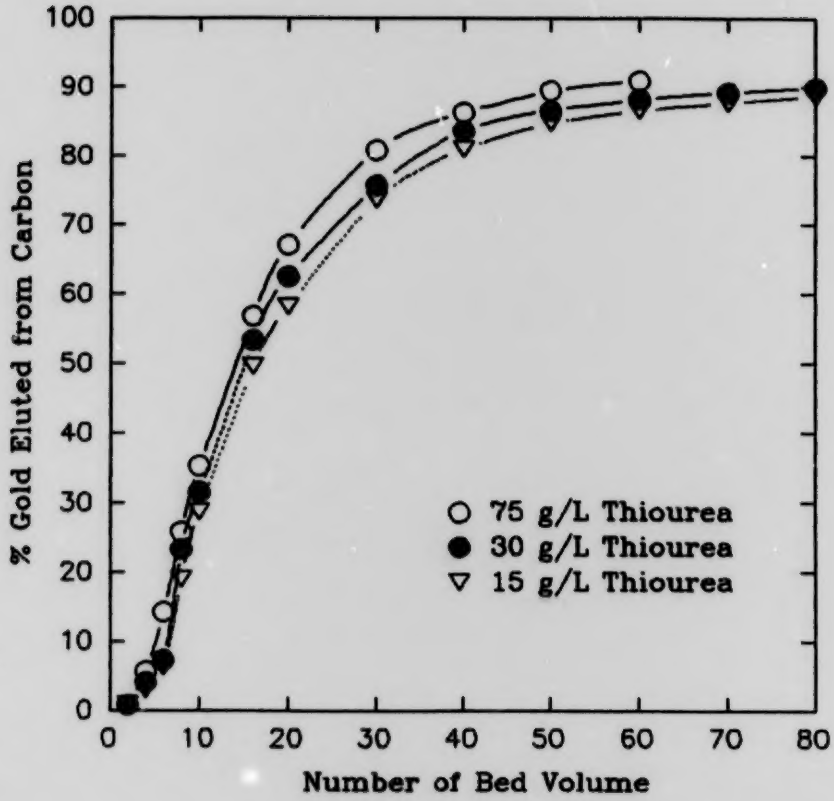


Figure 9, Effect of Thiourea Concentration on Carbon Elution Using Butanol
5% Butanol & 50 g/L Sulphuric Acid

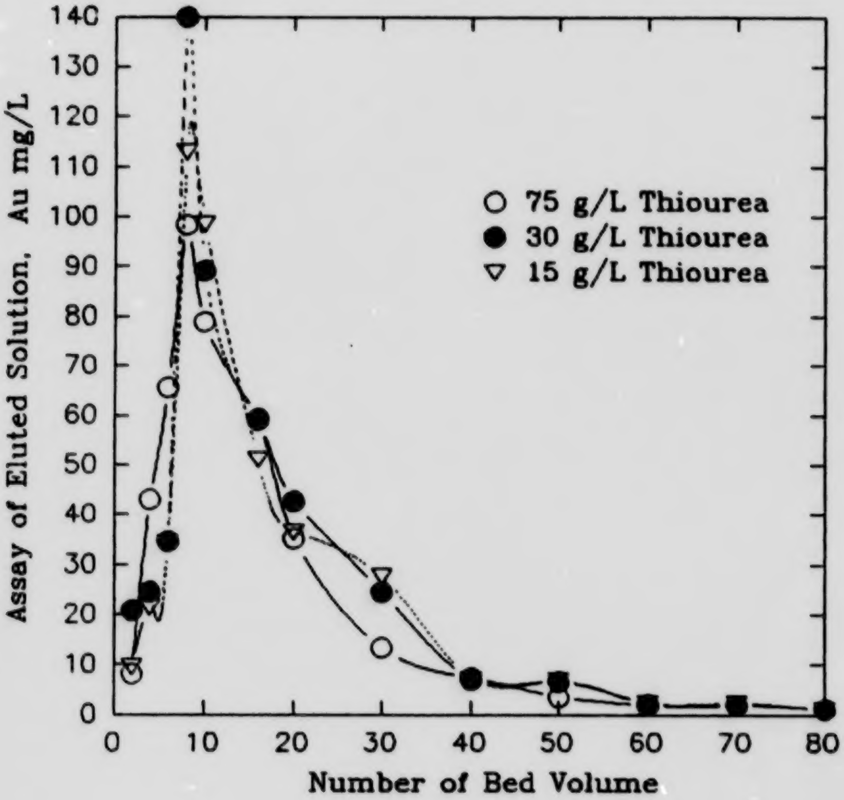


Figure 10, Effect of Thiourea Concentration on Solution Eluted from Carbon Using Butanol
5% Butanol & 50 g/L Sulphuric Acid

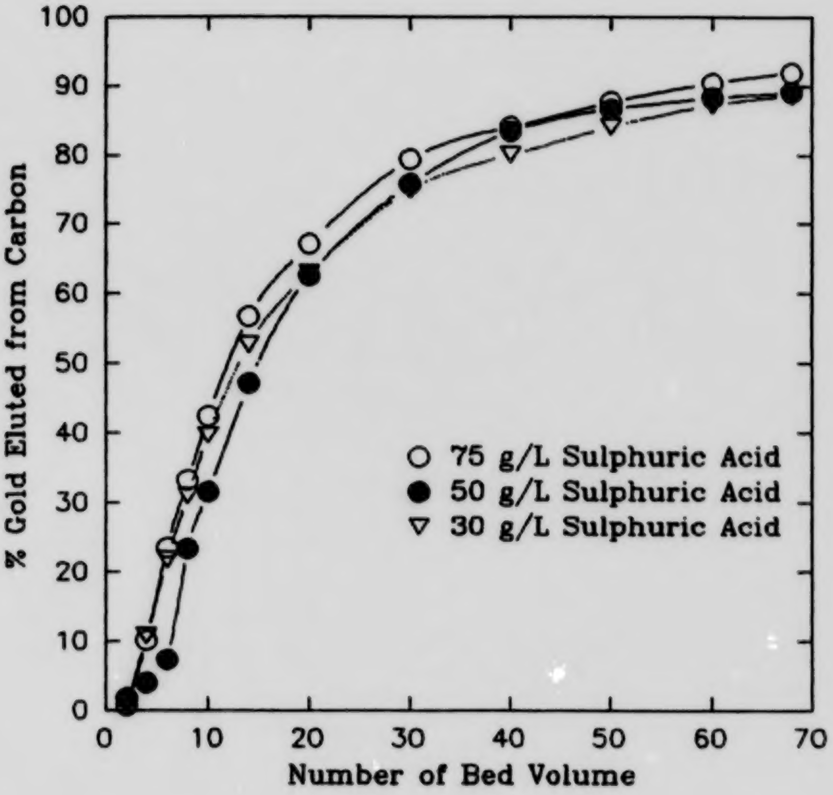


Figure 11. **Effect of Sulphuric Acid Concentration on Carbon Elution Using Butanol 5% Butanol & 30 g/L Thiourea**

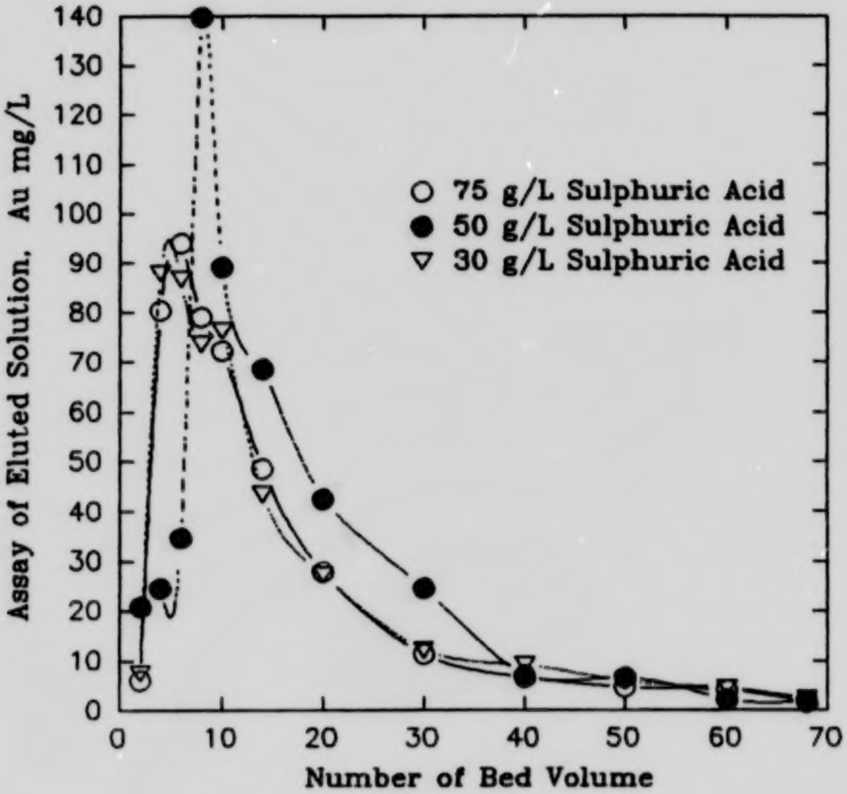


Figure 12, Effect of Sulphuric Acid Concentration on Solution Eluted from Carbon Using Butanol
5% Butanol & 30 g/L Thiourea

3.2.3.3, Effect of Solution Temperature: The basic solution composition is 5% butanol, 50 g/L thiourea and 50 g/L sulphuric acid. The solution temperature varies from room temperature (20^{0}C) to 40^{0}C and 60^{0}C. Figure 13 shows that solution temperature has significant effect on gold elution from carbon. When the solution temperature is 40^{0}C, the gold elution is 25% faster than the gold elution at 20^{0}C. With 60 bed volume elution solution, the gold elution increases from 80% at 20^{0}C to 90% at 40^{0}C. The residual carbon assay is 0.28 mg/g Au. As the solution temperature further raised to 60^{0}C, the gold elution at initial 20 bed volume is 10% - 20% lower than the elution with 40^{0}C solution. This may be due to the thiourea decomposition at 60^{0}C. However the gold elution increases from 90% at 40^{0}C to 94% by 60^{0}C solution with 60 bed volume elution. The solution assay profile as shown in Figure 14 indicates that the highest solution assay is 220 mg/L Au.

If the concentrations of thiourea and sulphuric acid increase to higher than 50 g/L and solution temperature is higher than room temperature, the results of Table III indicate that the gold elution improve to 99% with the residual carbon assayed 0.02 mg/g Au.

Table III, Gold Elution with Butanol

Test No.	TU g/L	Acid g/L	Temp ^{0}C	% Au Extra'tn	F. Carbon mg/g Au	Head mg/g Au
59	50	50	40	89.9	0.47	4.68
60	50	50	60	94.2	0.28	4.81
61	50	75	40	93.9	0.28	4.53
62	50	75	60	94.7	0.26	4.93
69	50	100	60	98.0	0.09	4.54
70	100	100	40	93.3	0.34	5.10
71	100	100	60	99.6	0.02	4.93

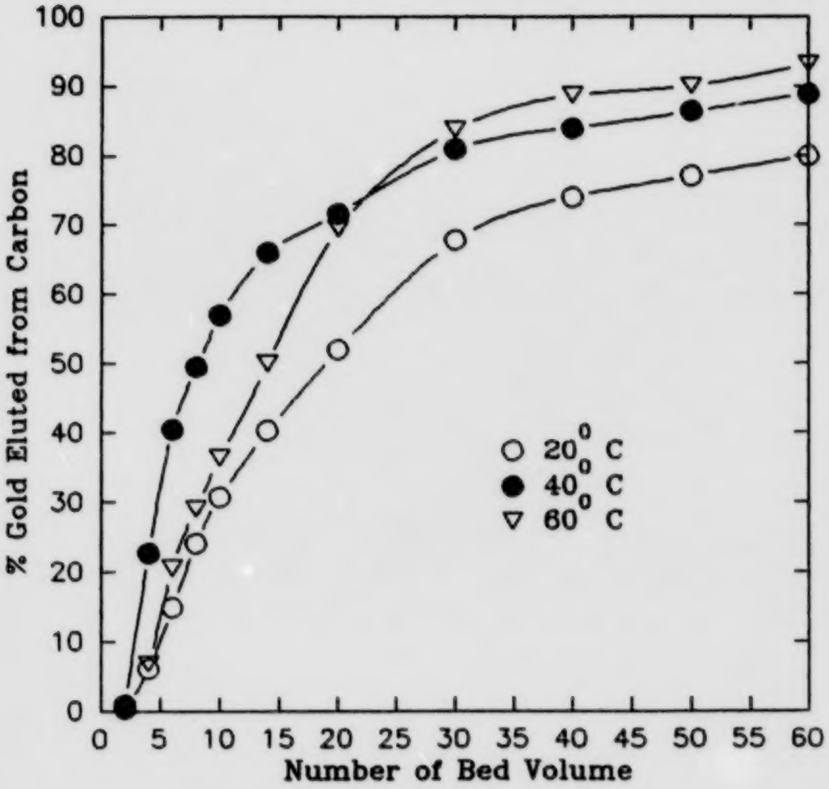


Figure 13, Effect of Solution Temperature on Carbon Elution Using Butanol
5% Butanol, 50 g/L Thiourea, 50 g/L Sulphuric Acid

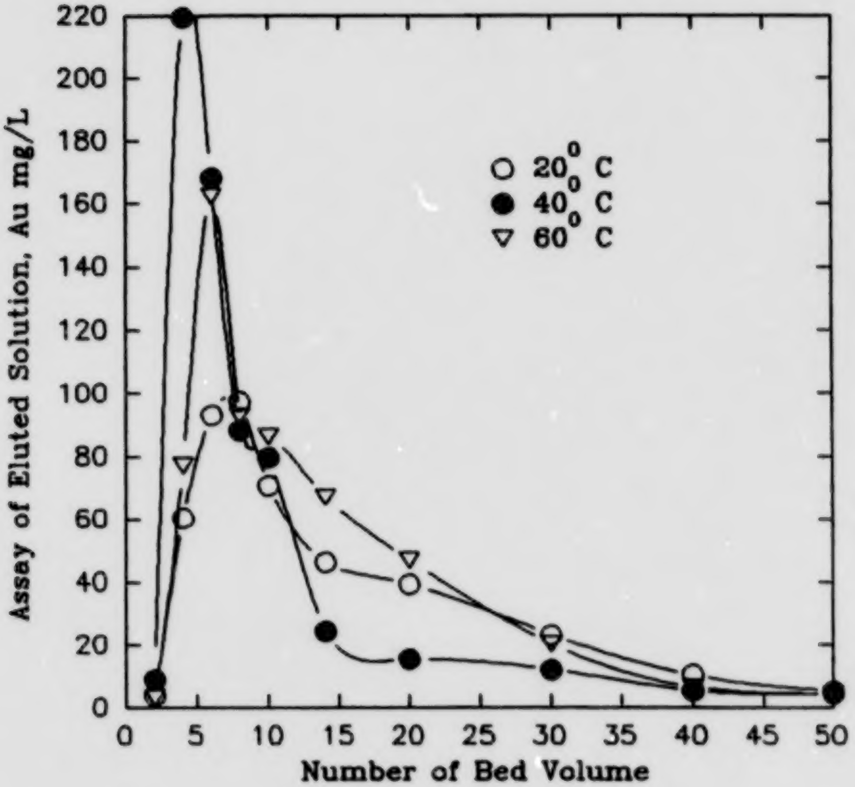


Figure 14. Effect of Solution Temperature on Solution Eluted from Carbon Using Butanol
5% Butanol, 50 g/L Thiourea, 50 G/L Sulphuric Acid

3.2.3.4, **Effect of Organic Combination:** The basic solution composition is 50 g/L thiourea and 50 g/L sulphuric acid. Butanol concentrations of 5% and 10% have been mixed with 10% to 15% of acetonitrile or acetone. The result of organic combination on gold elution is summarized in Table IV.

Table IV. Effect of Organic Combination on Gold Elution

Test No.	Aceton-itrile%	Butanol %	Acetone %	% Au Extr.	Carbon mg/g Au	Head mg/g Au
8		10	10	93.0	0.60	8.57
21	10	5		90.3	0.38	3.92
22	15	5		92.7	0.31	4.19
64	10	10		91.3	0.43	5.08

Above result indicate that all organic combination could elute more than 90% gold from the carbon. The best result is obtained by the combination of 5% butanol and 15% acetonitrile or 10% butanol and 10% acetone. The carbon desorption is 93%. The residual carbon assay is in the range of 0.31 mg/g Au and 0,60 mg/g Au.

3.2.4, Elution with Acidic Thiourea Diethyl Ether

The stripping solution contained 50 g/L thiourea, 50 g/L sulphuric acid and 5% or 10% diethyl ether is used to elute gold from the carbon. Figure 15 shows the effects of diethyl ether concentration and solution temperature on carbon elution. At room temperature 50% gold is eluted by 50 bed volume 5% diethyl ether solution and 75% gold is eluted by same bed volume of 10% diethyl ether.

As the solution temperature is raised to 40^0C, the gold elution from the carbon is greatly increased. The gold elution at 40^0C increases from 50% at room temperature to 70% by 5% diethyl ether and from 75% at room temperature to 85% by 10% diethyl ether solution. The best residual carbon assayed 0.84 mg/g Au. Figure 16 shows the profile of solution assay.

3.2.5, Elution with Acidic Thiourea Ethanol

The composition of the stripping solution contains 50 g/L thiourea, 50 g/L sulphuric acid and 5% - 20% ethanol. Figure 17 shows that less than 15% gold is eluted from carbon by 40 bed volume elution solution. If the concentration of ethanol or thiourea and sulphuric acid concentration is further increased, the improvement of gold elution is possible. Figure 18 shows the profile of eluted solution assay. The highest solution assay is only 10 mg/L Au.

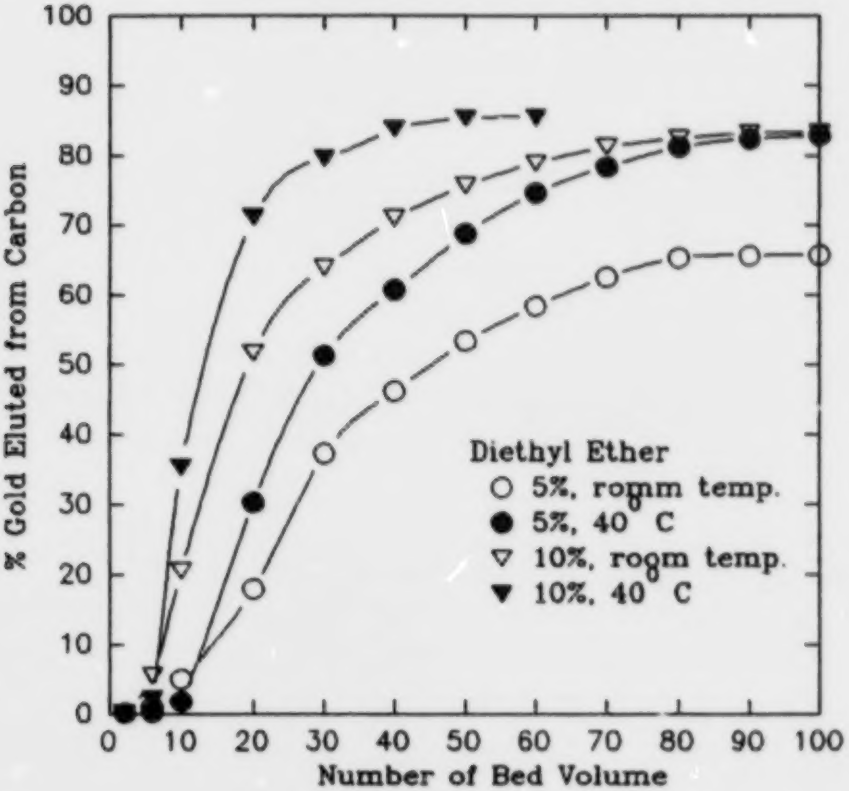


Figure 15. Effects of Diethly Ether Concentration and Solution Temperature on Carbon Elution

50 g/L Thiourea, 50 g/L H_2SO_4

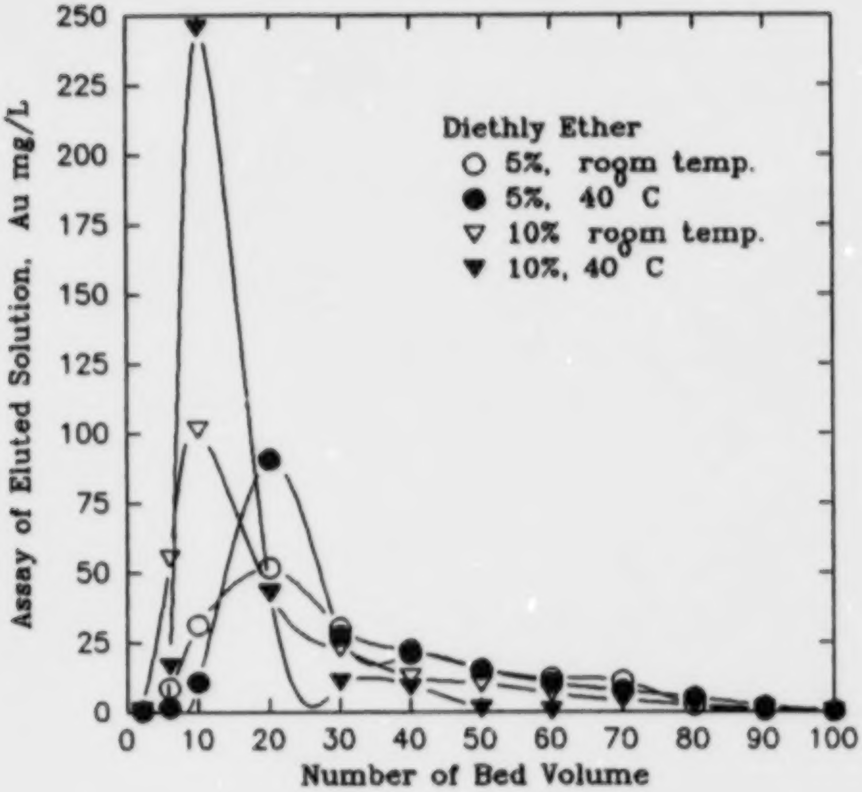


Figure 16, Effects of Diethly Ether Concentration and Solution Temperature on Eluted Solutions

50 g/L Thiourea and 50 g/L H_2SO_4

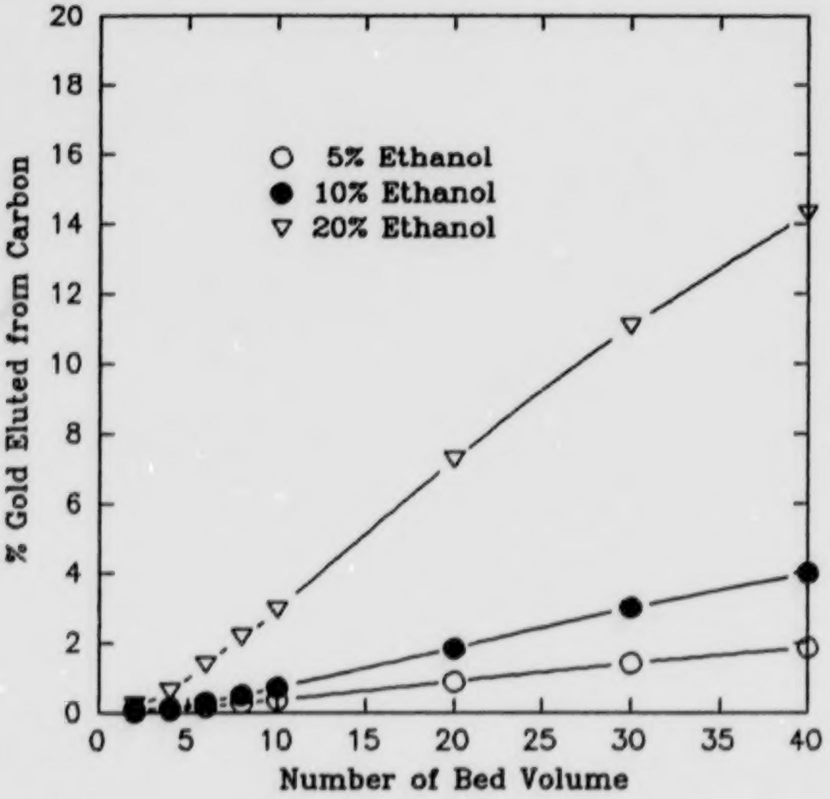


Figure 17, Effect of Ethanol Concentration on Carbon Elution

50 g/L Thiourea, 50 g/L H_2SO_4

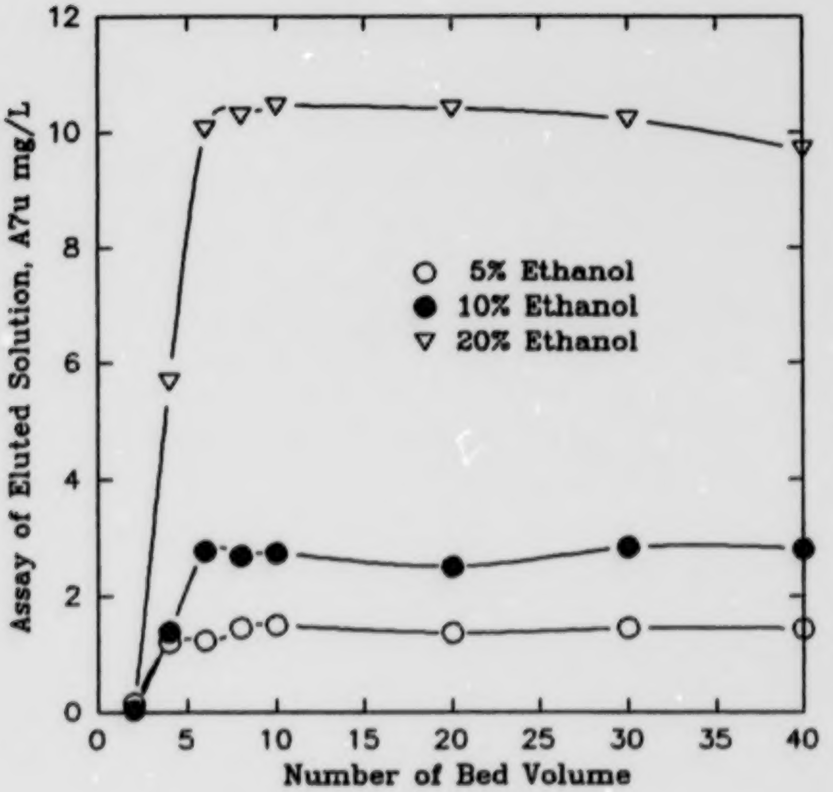


Figure 18. Effect of Ethanol Concentration on Eluted Solution

50 g/L Thiourea, 50 g/L H_2SO_4

3.2.6, Elution with Sodium Sulphide

3.2.6.1, Effect of Sodium Sulphide Concentration: Figure 19 shows the effect of sodium sulphide concentration on % gold eluted from carbon. As sodium sulphide concentration is lower than 0.25 moles, the gold elution is less than 70% by 50 bed volume solution. When sodium sulphide concentration is higher than 0.5 moles, the percentage of gold elution is higher than 92%. Most of gold is eluted at the initial 10 - 20 bed volume. With 10 bed volume elution solution, 90% gold is eluted by 1.0 mole sodium sulphide solution and 99% gold is eluted by 2.0 moles sodium sulphide solution, where the residual carbon assay is 0.10 mg/g Au and 0.04 mg/g Au respectively.

Figure 20 shows the profile of eluted solution assay by using different sodium sulphide concentration. The solution assay is less than 100 mg/L Au as the elution solution concentration is lower than 0.25 mole sodium sulphide. As the sodium sulphide concentration is higher than 0.5 mole, the solution assay at initial 6 bed volume is higher than 200 mg/L Au. The highest solution assay is 600 mg/L Au, 800 mg/L Au and 1850 mg/L Au by using 0.50 moles, 1.0 mole and 2.0 moles sodium sulphide respectively.

3.2.6.2, Effect of Solution Temperature: The temperature of 0.5 M Na_2S solution was raised from 25^0 C to 95^0 C. Figure 21 shows that the solution at 40^0 C is faster in the initial stage than at ambient temperature and come up the same after 20 bed volume elution. The maximum gold elution was 92% for both conditions. As the solution temperature increased to 95^0 C, 97% of gold was eluted in 10 bed volume or five hours elution. More than 99% of gold was eluted with less than 30 bed volume solution.

Figure 22 shows the assay profile of the eluted solution under the same conditions. The highest solution assay at 25^0 C and 40^0 C is 570 mg/L Au and at 95^0 C is 695 mg/L Au. More than 95% of gold is in the initial eight bed volume solution. The assay after 20 bed volume is less than 2 mg/L Au.

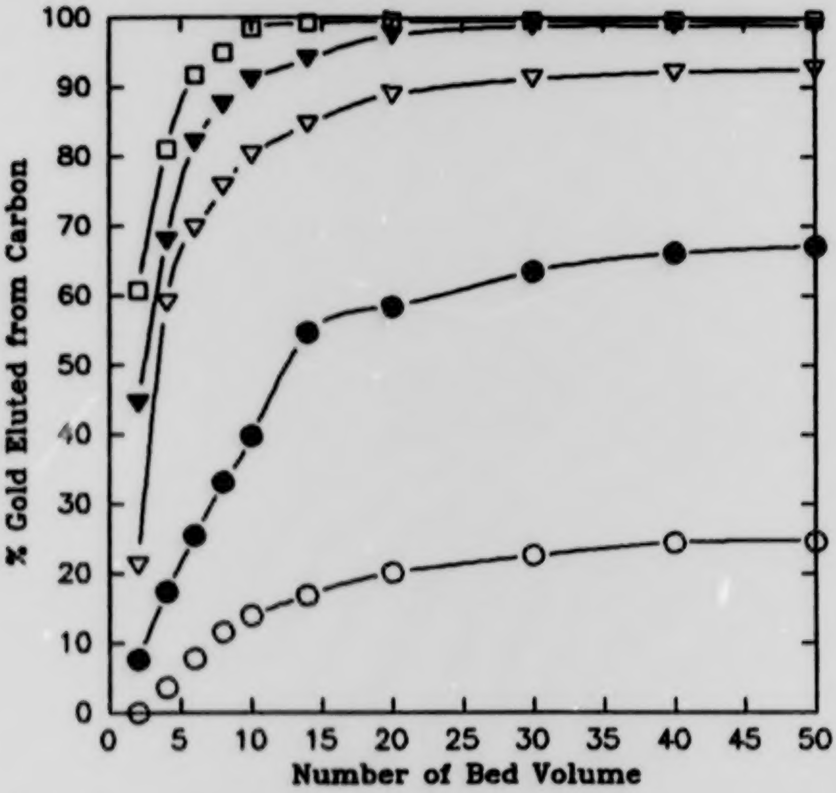


Figure 19 Effect of Sodium Sulphide Concentration on Carbon Elution
○ 0.125 M, ● 0.250 M, ▽ 0.50 M
▼ 1.000 M, □ 2.000 M

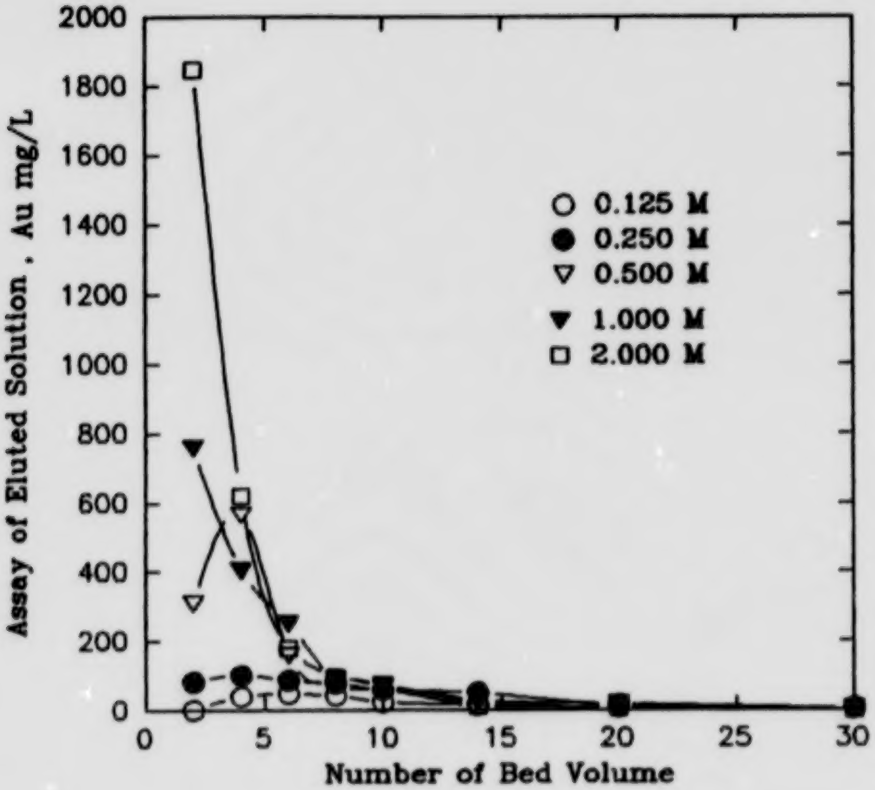


Figure 20, Effect of Sodium Sulphide Concentration on Eluted Solution Assay

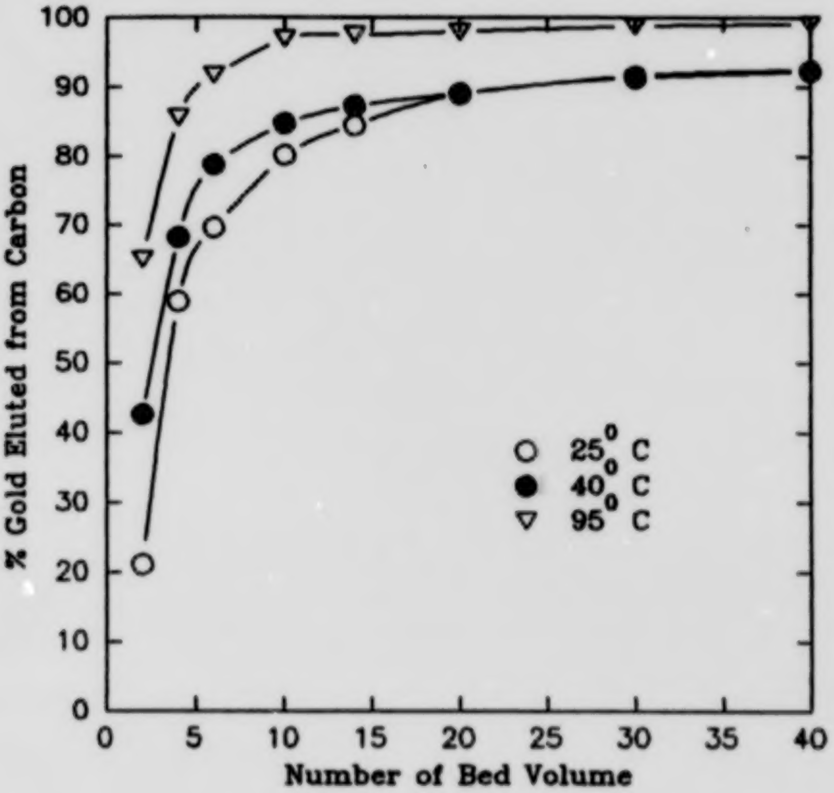


Figure 21. Effect of Solution Temperature on Carbon Elution with 120 g/L (0.5 M/L) Na_2S

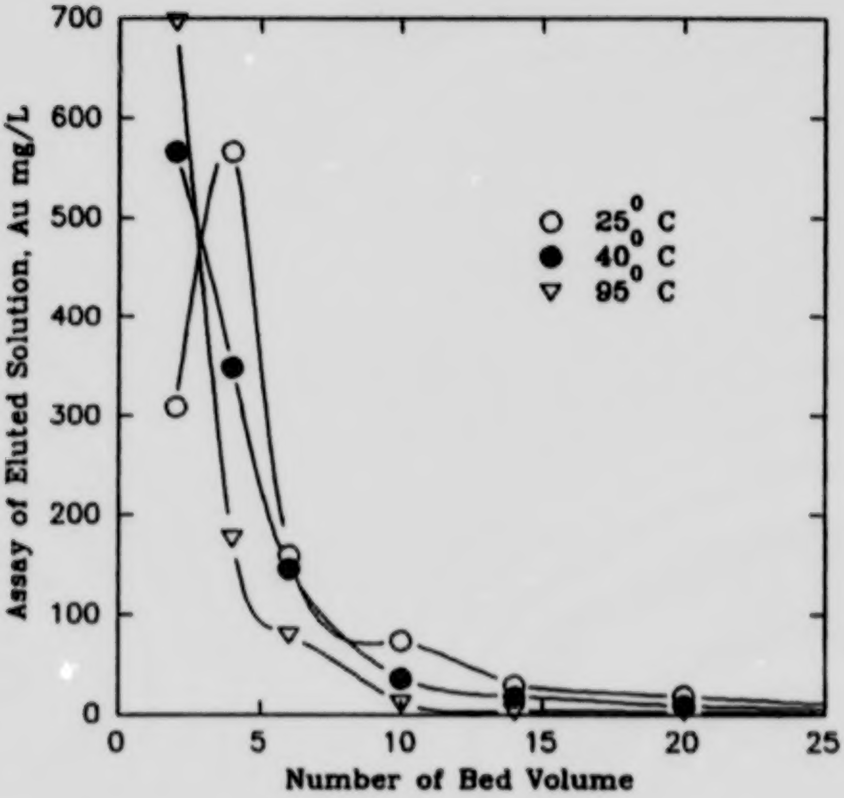


Figure 22, Assay Profile of Eluted Solution Using 120 g/L Na_2S at Various Temperature

3.2.7, Elution with Sodium Thiosulphate

The sodium thiosulphate solution at the concentration of 50 g/L is used to elute carbon at room temperature and 50°C. The result of Figure 23 indicates that gold elution at initial 8 bed volume is less 10%. The elution percent increases steadily with elution bed volume after 10 bed volume. The solution at room temperature elutes 91% gold from the carbon with 60 bed volume solution leaving the residual carbon assayed 0.32 mg/g Au. Gold elution at 50°C reaches a plateau at 40 bed volume with 95% of gold recovery. 98% gold recovery is achieved with 60 bed volume elution leaving the residual carbon assayed 0.13 mg/g Au.

Figure 24 shows the profile of solution assay under the same conditions. The solution assay for both temperature elution is lower than 50 mg/L Au at initial 10 bed volume. The solution assay value at room temperature elution stays above 50 mg/L Au between 15 and 50 bed volume. The solution assay value at 50°C elution stays above 50 mg/L Au between 6 and 30 bed volume. The width of the peak is wider than other elution systems.

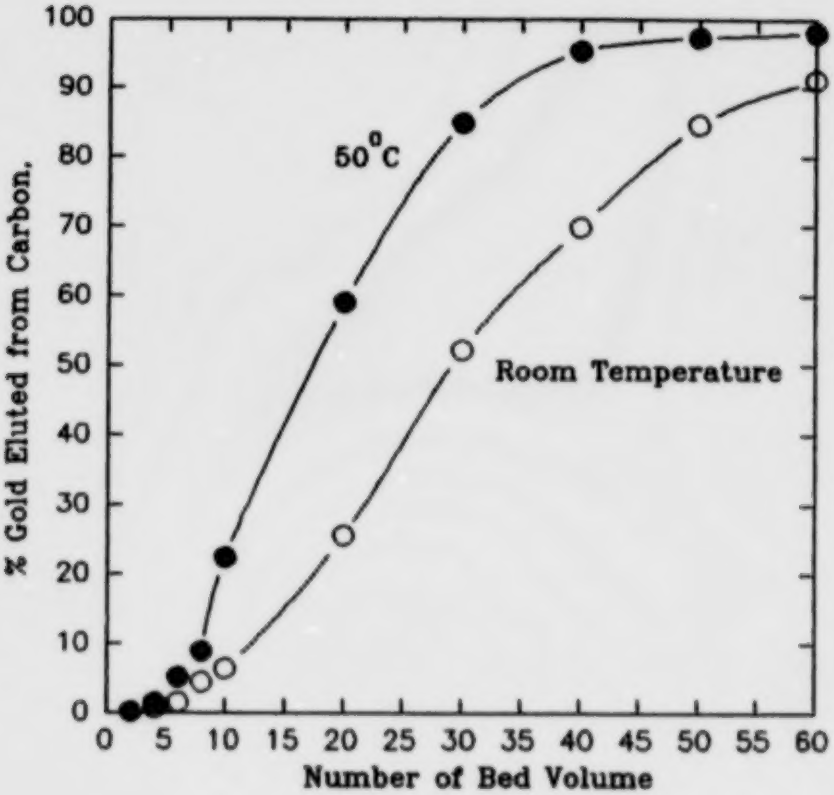


Figure 23, Carbon Elution by Sodium Thiosulphate
50 g/L $Na_2S_2O_3$

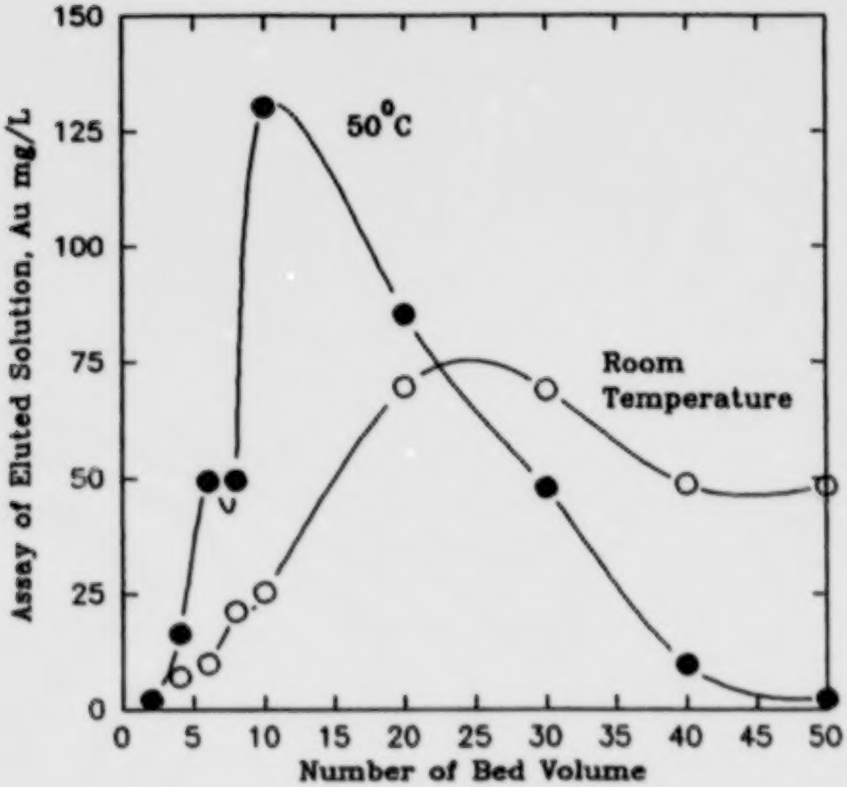


Figure 24. Solution Assay Eluted from Carbon by Sodium Thiosulphate

50 g/L $Na_2S_2O_3$

3.2.8. Elution with Caustic Cyanide Solution

High concentration of sodium cyanide and sodium hydroxide were used to elute the carbon at 140^0 C. The concentration of sodium hydroxide was 10 g/L NaOH and the concentration of sodium cyanide was either 1 g/L NaCN or 2 g/L NaCN.

Result of Figure 25 shows that there are a great difference in elution efficiency for the carbon washed or without washed with acid. The gold loaded carbon also loaded with iron and other impurities, which may consume some constituents in the eluant and diminish the elution efficiency. The gold eluted from carbon without washed with acid is only 70% or less by 25 bed volume solution. After the carbon washed with acid to remove iron and impurities, 96% of gold was eluted from the carbon with 22 bed volume solution. The final eluted carbon assayed 0.17 mg/g Au or 170 grams gold per tonne of carbon.

Figure 26 shows the assay pofile of eluted solution. The solution concentration from un-washed carbon is high at the initial eight bed volume with the highest assay below 120 mg/L Au. While the solution concentration from acid washed carbon remains high even up to 20 bed volume. The highest assay is 250 mg/L Au, which occurs at 12th bed volume point. Normally the highest solution assay occurs at the initial 10 bed volume range. Unusual phenomena happened for this case may be due to the strong adsorption of gold thiourea on the carbon surface.

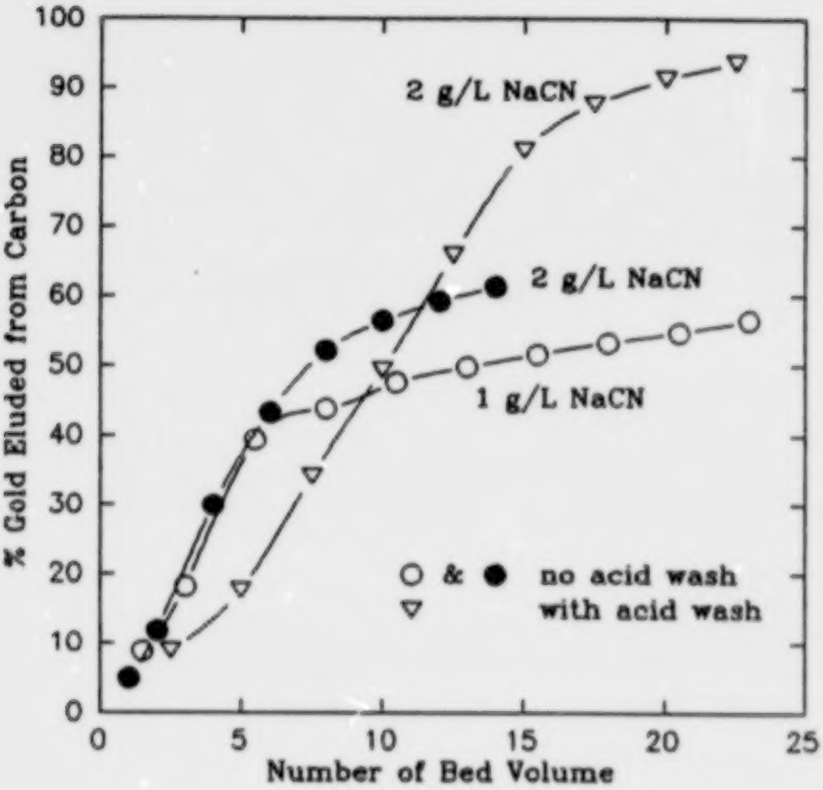


Figure 25, Carbon Desorption with Cyanide Caustic Solution at 140° C: 10 g/L NaOH

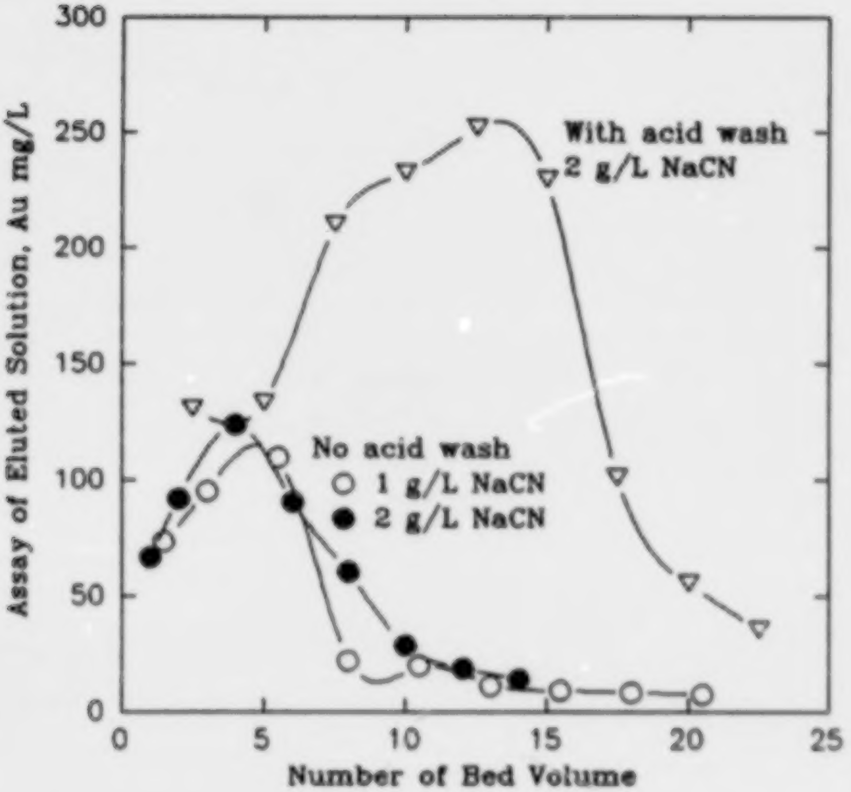


Figure 26. Assay Profile of Eluted Solution Using Cyanide Caustic Solution at 140 °C; 10 g/L NaOH

3.2.9, Elution with Sodium Carbonate Solution

A 2% sodium carbonate solution was prepared to elute the carbon at 140° C. Carbons of acid washed and un-washed were used for elution test. Figure 27 shows that the elution efficiency for both cases are very low. Only 35% of gold is eluted from the carbon without acid wash. After the carbon is washed with acid to remove iron and other impurities, 66% of gold is eluted from the carbon. The final eluted carbons assayed 1.56 mg/g Au and 1.34 mg/g Au respectively. Interesting point to note for this elution process is the curves reached a plateau at 6 bed volume elution. The elution is virtually nil after this point.

Figure 28 shows that the assay profile of the eluate using sodium carbonate as the eluant. At second and forth bed volume point, the eluate assayed 350 mg/L Au and 380 mg/L Au. After sixth bed volume the eluate assay is very low, which indicated that there are very few gold being eluted at this point.

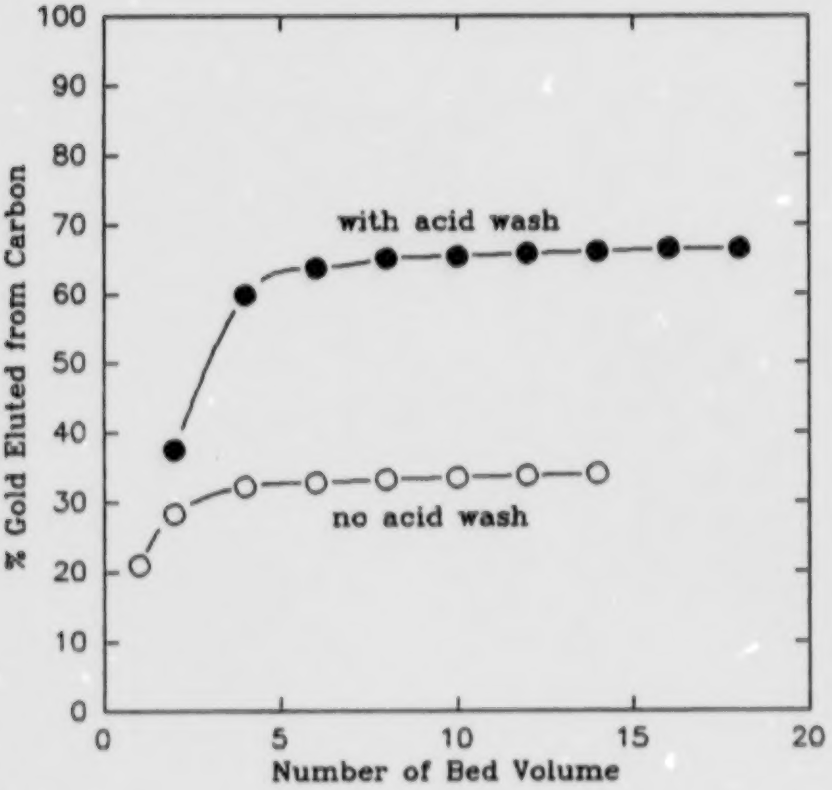


Figure 27. Carbon Desorption with 2% Na_2CO_3 Solution at 140° C

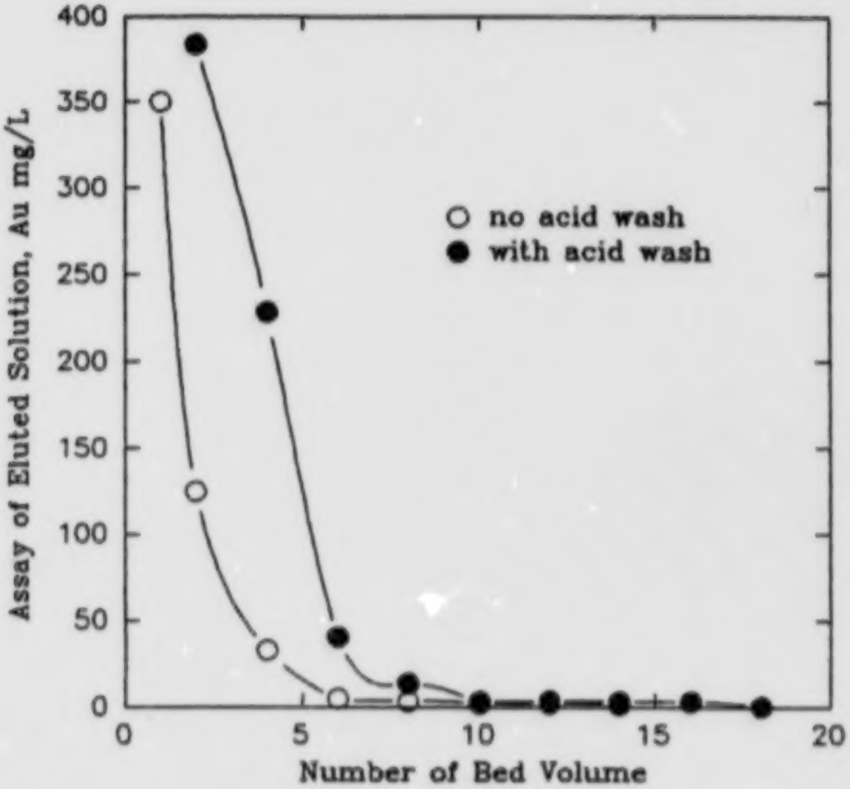


Figure 28. Assay Profile of Eluted Solution Using $2\%\ Na_2CO_3$ Solution at 140^0 C

3.2.10, Elution with Alkaline Thiourea Solution

The combined solution of thiourea and sodium hydroxide have been used to elute the carbon at ambient temperature and the results was very poor. As the solution temperature increased, the carbon elution efficiency increased. The best conditions found is to use an eluant contained 3% thiourea, 1% NaOH and 0.05% NaCN at 95^0 C. Figure 29 shows that 92% of gold is eluted with 12 bed volume solution and 97% of gold is eluted with 20 bed volume solution. The chemistry of this elution system may be attributed to the reaction of thiourea and sodium hydroxide producing sodium sulphide as shown in the following equation:

$$SC(NH_2)_3 + 2NaOH \; - \; Na_2S + CNNH_2 + 2H_2O$$

There are evidences to indicate that sodium sulphide play the major role in the carbon elution. The results of Figures 21 and 29 support this assumption. Slower elution rate at the initial bed volume as shown in Figure 29 may be due to the concentration of Na_2S is slightly lower in the initial stage of the reaction. The final eluted carbon using this process assayed 0.17 mg/g Au or 170 gram gold per tonne of carbon.

Figure 30 shows the assay profile of the eluate under the best elution condition. The solution concentration is high at the initial 10 bed volume solution. The highest solution assay is 487 mg/L Au at 4th. bed volume stage.

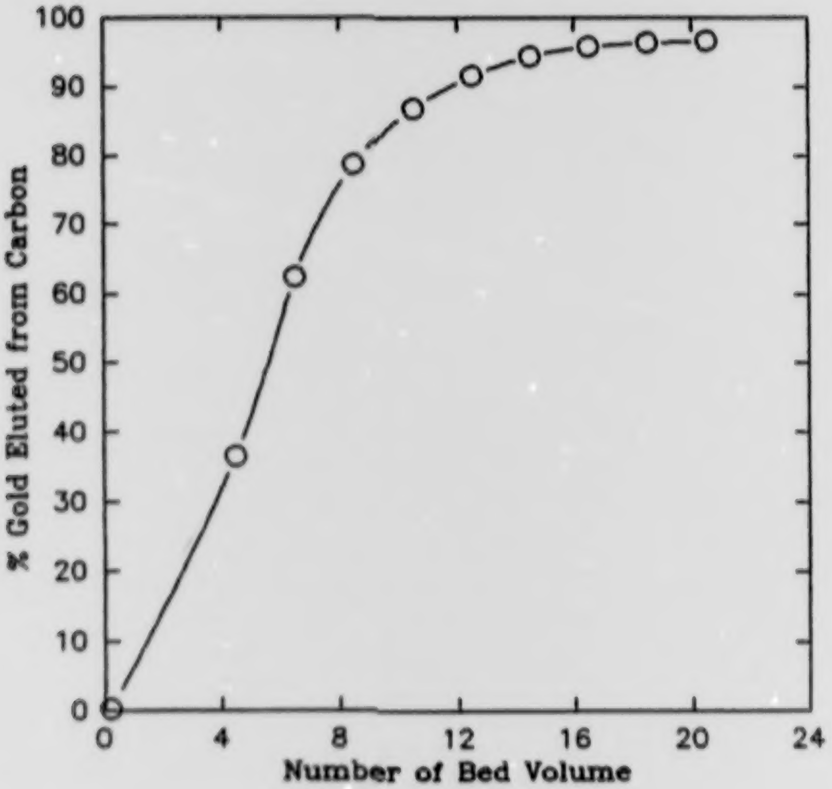


Figure 29, Carbon Desorption Using Alkali Thiourea Solution at 95°C:
3% Thiourea, 1% NaOH & 0.05% NaCN

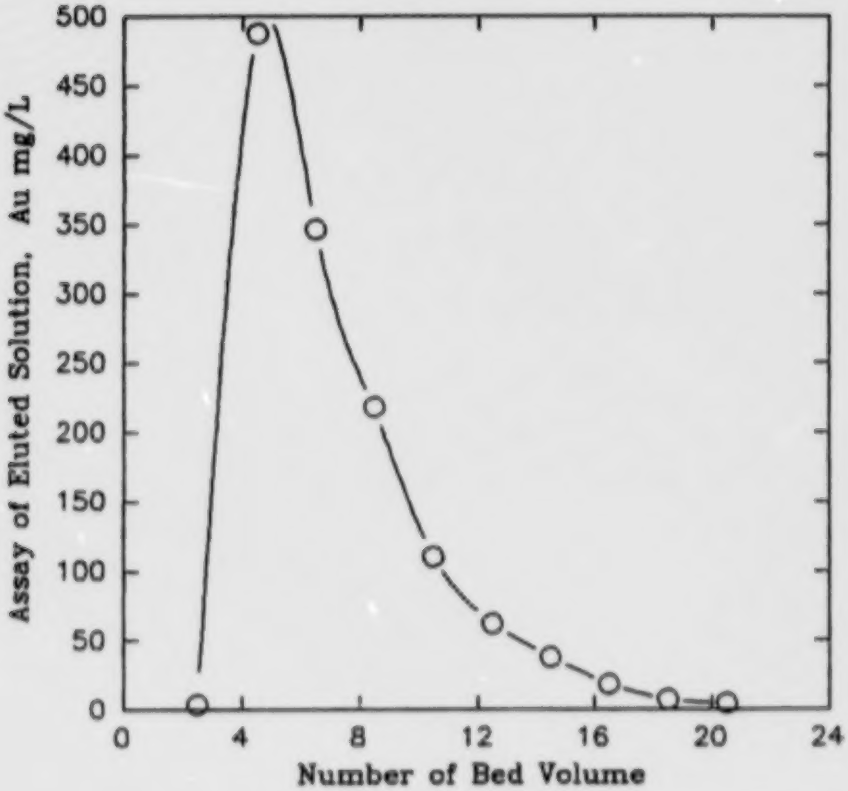


Figure 30. Assay Profile of Eluted Solution Using Alkali Thiourea Solution at 95° C
3% Thiourea, 1% NaOH & 0.05% NaCN

3.3. Carbon Regeneration Test:

The eluted carbon should able be re-cycled to the adsorption circuit. The feasibility of carbon re-cycling depends on the activity of the eluted carbon. Therefore, we should know the activity of the carbon before and after elution. If the activity of the eluted carbon is greatly diminished, the regeneration process has to apply to the carbon and restore its activity. The results of carbon activity and regeneration are shown in following sections.

3.3.1. Activities of Fresh and Eluted Carbons

The K- and R-values are used to define the activity of carbon. Table V shows the activity of fresh Calgon GRC 6X16 activated carbon by adsorbing gold from both gold cyanide complex and gold thiourea complexes.

Table V. K- and R-values of Fresh Carbon

Au Adsorption Solution	K-value		R-value		
	Test No.	K value	Test No.	R %	R t/(X/M)
Gold-cyanide	104	33.3	104	36.8	0.0612
Gold-thiourea	84	41.9	85	38.2	0.0625

The standard values for GRC 6X16 carbon reported by Calgon Carbon Corporation are: K-value is 32 and R-value is 0.075. The values obtained in this investigation, i.e., K = 33.3 and R = 0.0612, are very close to the standard values. The slightly lower R-value in our result is due to the carbon particle size in our test procedure was 6 X 16 mesh while the standard test carbon is pulverized to 95% minus 325 mesh.

Comparing the K-values obtained from gold-cyanide and gold-thiourea solutions, results indicate that carbon loading from gold-thiourea solution is much higher than that from gold-cyanide solution.

The R-value for the carbon adsorbed gold from both gold-cyanide and gold-thiourea solutions are about the same, i.e. 0.0612 vs. 0.0625. or 36.8% vs. 38.2%.

Three types of eluted carbons, which demonstrated the best carbon elution results, were selected for K- and R-values determination. The results are summarized in Table VI.

Table VI. R- and K-values of Eluted Carbons

Eluant	Elu. Test No.	K Value		R Value		
		Test No.	K Value	Test No.	R %	R t/(X/M)
NaCN NaOH	81*	88*	21.2	99*	23.1	0.0383
	83	86	42.5	87	68.3	0.1135
Butanol TU	76	115	43.2	91	32.0	0.0532
	69	94	43.9	93	33.4	0.0555
Na_2S	80	113	43.9	89	37.9	0.0518
	26	96	45.3	95	40.7	0.0677
	27	98	44.5	97	55.4	0.0922

* Carbon adsorb gold from gold-cyanide solution
All others adsorb gold from gold-thiourea solution

Above results indicate that the cyanide eluted carbon did lost its rate of gold adsorption and carbon loading in the gold cyanide solution. Both of K- and R-values reduced from thirties to 21.1 and 23.1 respectively ----- ã 30% reduction.

The activity of eluted carbon in the thiourea solution is much different as in the cyanide solution. The K-values of the eluted carbons by three eluants remain the same as the fresh carbon, i.e., 42 to 45. The R-values of the carbons eluted with NaCN-NaOH and Na_2S also remain the same as the fresh carbon or better, i.e., 38 to 68. The R-value of the carbon eluted with butanol-thiourea has reduced from 38 to 32 and 33 ----- a 13% to 15% reduction.

The results indicate that the carbons eluted with NaCN-NaOH and Na_2S solutions can be directly recycled to the adsorption circuit several times till regeneration required. The carbon eluted with butanol-thiourea solution has to be regenerated and then allowed to recycle.

3.3.2, Carbon Recycle and Regeneration

For carbon recycle test, the eluted carbons with NaCN-NaOH and Na_2S solutions were used to adsorb gold from the fresh gold thiourea solution to a loading of 5 - 8 mg/g Au, followed by standard elution procedure with NaCN-NaOH and Na_2S solutions. Five cycles were conducted on the same carbon sample. The results of carbon activities in each cycle are summarized in Table VII.

Table VII, Activities of Recycled Carbons

Eluant	Activity	Number of Recycle				
		1st.	2nd.	3rd.	4th.	5th.
Na_2S	K-value	43.9	44.4	41.3	28.2	19.6
	R-value	37.9	31.6	30.6	28.3	22.0
NaCN NaOH	K-value	57.2	43.4	42.4	28.6	18.7
	R-value	46.1	44.7	40.3	24.1	19.6

Above results indicate that the K-values of eluted carbons from both eluants remain almost constant (above 40) up to third cycle and then diminish to below 30 after fourth cycle. At fifth cycle, the K-value is less than one half of the fresh carbon.

The R-value of the eluted carbon with NaCN-NaOH solution remain above 40 up to third cycle and then reduced to below 24 after fourth cycle. The R-value of the eluted carbon with Na_2S solution start to diminish from 40 to 37.9 at the first cycle and remain around 30 up to third cycle. The R-values of 4th and 5th cycles are below 30.

The results conclude that the carbon eluted with NaCN-NaOH can be recycled three times before regeneration and the carbon eluted with Na_2S solution can only recycled once.

The carbon regeneration was conducted in a horizontal furnace with a rotation quartz tubing. The operation variables include temperature, retention time and moisture. The conditions and results are summarized in Table VIII.

In general, the carbon activity increases with increasing the temperature and retention time. The retention time is more important at the temperature of 500° C. The K-value increases from 34.8 at 20 minutes to 37.5 at 60 minutes. As the temperature raised to 700° C and 800° C, the K-value is about the same up to 40 minutes and then start to increase at 60 minutes. The relationship of R-value to retention time and temperature has the same trend as the K-value. The effect of moisture content obviously better than in the dry condition.

The best regeneration conditions are 700° C at 60 minutes and 800° C at 60 minutes, which restore the carbon activity respectively to: K = 43.5, R = 40.9 and K = 50.4, R = 46.5. If retention time reduced to 20 minutes, the activity can be increased from K = 42.4, R = 38.5 to K = 46.7, R = 41.6 by doing second 20 minutes regeneration.

Table VIII. Carbon Regeneration Conditions and Results

Time min.	H_2O	500°C		600°C		700°C		800°C	
		K	R	K	R	K	R	K	R
20	No	34.8	32.2	39.6	31.7	42.4	38.5		
	Yes					42.5	38.8	44.1	43.8
40	No	36.8	35.3			43.2	39.4		
	Yes					43.6	39.9	44.8	44.9
60	No	37.5	39.2			43.5	40.9		
	Yes	38.9	44.4			45.8	41.3	50.4	46.5
20 2nd	No					46.7	41.8		
	Yes								
20 3rd	No					47.0	42.8		
	Yes								

4, DISCUSSION

4.1. Carbon Adsorption

The concentrations of thiourea, iron and copper are higher than gold in the column leach solution. The activated carbon adsorb some of thiourea, iron, copper and also gold from the solution. The carbon adsorption efficiency is very well. In the initial 1000 bed volume solution, more than 90% gold adsorb on the carbon (based on individual bed volume). The overall 90% gold recovery can be extend to 1800 bed volume. This relationship can be described by following equation:

$$Y = aX + bX^2 + cX^3 \qquad (1)$$

where Y = % Au recovery
X = number of elution bed volume
a = 98.885742
b = -9.7^{-7}
c = -8.459^{-10}

The relationship of carbon loading and elution bed volume is shown as:

$$Z = a + bX + cX^3 \qquad (2)$$

where Z = carbon loading, mg/g Au
X = number of elution bed volume
a = -0.025698684
b = 0.0010673144
c = -3.5883646^{-11}

The coefficients a, b, and c depend on the pregnant solution assay. In equations (1) and (2) the solution assay is 0.5 mg/L Au.

4.2. Carbon Elution with Acidic Thiourea Organic Solutions

Five organic solvents, acetone, acetonitrile, butanol, diethyl ether and ethanol, are mixed with sulphuric - thiourea solution to desorb gold from the carbon. The carbon elution efficiency depends on the concentrations of thiourea, sulphuric acid, organic solvent and solution temperature. One of most important factors is the type and concentration of organic solvent. To compare the desorption efficiency of organic solvent, a standard condition is set up as: room temperature, 50 g/L thiourea, 50 g/L sulphuric acid and 50 bed volume at 2 bed volume per hour. Different organic solvent is added into the standard solution for elution test. The result is summarized in Table IX.

Table IX, Comparison of Organic Solvents

Organic Solvent	Conc. %	%Au desorb at 50 BV	F.Carbon Total BV	Test No.
Butanol	5	84.5	0.45/80	19
Acetonitrile	20	78.1	1.25/64	7
	30	87.0	0.53/86	33
Diethyl Ether	15	49.2	2.69/56	40
	20	60.0	2.42/40	41
Ethanol	20	11.6	6.36/60	5
Acetone	20	9.2	6.11/60	6
	30	64.3	1.94/60	67
	40	82.0	1.20/32	48

Note: F.Carbon Total BV:- Final carbon assay mg/g Au
Total elution bed volume

It is very difficult to compare the organic solvents in same concentration. The reason is that the solubility of butanol is less than 10% and other solvents have no carbon desorption effect at concentration below 10%. Comparing the carbon desorption percent with 5% butanol and 20% of other solvents as shown in Table IX, the preference for organic solvent to desorb gold from carbon is in the following order:

Butanol > Acetonitrile > Diethyl Ether > Ethanol > Acetone

The concentrations of thiourea and sulphuric acid are not very sensitive to the carbon desorption. Maximum desorption percent for a single organic solvent in a 50 g/L thiourea and 50 g/L sulphuric acid solution at room temperature is about 90%. Mixing butanol and other solvents, such as acetonitrile and acetone, may increase the desorption percent to 92% - 94%. If the solution temperature is raised to 40°C or 60°C, 99% gold could be desorbed from the carbon. The residual carbon assays less than 0.05 mg/g Au.

Desorption kinetics of acidic thiourea organic system at room temperature is very slow. Usually it requires 50 bed volume or 25 hours to reach a complete carbon desorption. Increasing solution temperature may increase the desorption rate at the initial stage. Total desorption times required at room temperature and elevated temperature are about the same.

For normal desorption process, the assay of eluted solution is usually high at initial 10 bed volume. After that, the solution assay may be too low for further step of gold recovery.
The gold recovery from the eluate may be achieved by electrolysis method.

The eluted carbons from thiourea-organic system can be regenerated at 700° C or 800° C for 60 minutes to restore its activity. Carbon recycle is possible after the regeneration.

4.3. Elution with Sulphide and Thiosulphate Solutions

It is rather easier to desorb gold from carbon by using sodium sulphide and sodium thiosulphate solutions. The solutions of 1.0 M and 2.0 M sodium sulphide can desorb 98% - 99% gold from the carbon at room temperature in 30 and 15 bed volume respectively. Increasing the solution temperature may increase the desorption rate. With 0.5 M Na_2S solution at 95° C, 98% - 99% gold can be desorbed as fast as the 1 or 2M solution at ambient temperature.

Carbon desorption with sodium thiosulphate is less effective at room temperature. The 50 g/L sodium thiosulphate solution at 50°C can desorb 98% of gold from the carbon in 60 bed volume elution while only 91% gold is desorbed at room temperature. The eluted carbon can be regenerated and recycled.

The problem of sulphide or thiosulphate is the recovery of gold from eluted solution. It is found that the electrolysis in the sulphide solution may cause the oxidation of the sulphide to polysulphide at the anode of electrowinning cell; the polysulphide, which is a complexing ligand for gold, leaches the gold deposited at the cathode at the same rate at which the gold is deposited, thus limiting the electrowinning efficiency.

4.4. Elution with Caustic Cyanide and Alkaline Thiourea

Carbon desorption with caustic cyanide solution in the thiourea system is much difficulty than in the cyanide system. It required to pre-wash the carbon with acid at 80° C - 90° C, followed by the carbon elution with a strong solution concentration, i.e., 10 g/L NaOH, 2 g/L NaCN and high temperature, i.e., 140° C or higher.

Carbon desorption with alkaline thiourea solution is very promising since the reaction between thiourea and sodium hydroxide producing sodium sulphide, which act as a major role in carbon elution. However, the concentration of sodium sulphide produced in the reaction is low and the solution has to conduct at 95° C to give a good elution efficiency.

4.5. Rate Constant and Activation Energy of Carbon Elution

From the experimental data the elution rate can be calculated by the reduction of carbon loading at a specific elution time. Plotting the elution rate versus the elution time, the rate constant is found as a first order reaction. The specific rate constant is calculated from the slope of the straight line. Table X summarized the rate constant of various carbon elution conditions. Results indicate that the rate constant agree well with the elution efficiency. The highest elution constant is 0.6007 using 480 g/L Na_2S at ambient temperature. Normally the elution constant at 0.1 or higher will give a reasonable elution efficiency and produce a eluted carbon assay less than 100 gram Au per 1 metric tonne of carbon.

The activation energy of carbon elution can be calculated by plotting the logarithm of rate constant against the reciprocal of temperature in Kelvin. Three activation energy data is shown as below:

Eluant	Activation Energy, Kcal/mol
Butanol	1.62
Sodium Thiosulphate	6.37
Sodium sulphide	2.11

Table X. Rate Constant of Carbon Elution

Eluant	Temperature	Rate Constant
5% Butanol	60° C	0.1123
5% Butanol	40° C	0.0943
5% Butanol	25° C	0.0843
20% Acetonitrile	25° C	0.0674
20% Diethyl ether	25° C	0.0428
20% Ethanol	25° C	0.0048
20% Acetone	25° C	0.0038
1 g/L NaCN, 10 g/L NaOH	140° C	0.0836
2 g/L NaCN, 10 g/L NaOH	140° C	0.3081
30 g/L sodium sulphide	25° C	0.0289
60 g/L sodium sulphide	25° C	0.1005
120 g/L sodium sulphide	25° C	0.2761
240 g/L sodium sulphide	25° C	0.4396
480 g/L sodium sulphide	25° C	0.6007
120 g/L sodium sulphide	25° C	0.2761
120 g/L sodium sulphide	40° C	0.2947
120 g/L sodium sulphide	95° C	0.5297
50 g/L sodium thiosulphate	25° C	0.0573
50 g/L sodium thiosulphate	50° C	0.1316

5, CONCLUSION

The rate of gold thiourea complex loading onto the carbon is slow. It is not reaching equilibrium loading in one month adsorption. In the absence of any competition from other species in solution, the gold-thiourea complex is loaded to very high concentration onto activated carbon. However, excess thiourea plus iron and copper thiourea complex ions have a deleterious effect on the adsorption of gold-thiourea complex onto carbon. The adsorption percent and carbon loading can be calculated by the solution assay and solution bed volume. It is expected to load the carbon to 5 - 10 mg/g Au and barren solution assayed 0.005 mg/L Au.

Carbon desorption can be achieved by using a solution mixture of thiourea, sulphuric acid and organic solvent. The concentrations of thiourea and sulphuric acid are less sensitive to the carbon desorption. The most important factor for the desorption is the solution temperature, type and concentration of organic solvent. Five types of organic solvents are tested. The preference of the organic solvents is in the order of:

Butanol > Acetonitrile > Diethyl Ether > Ethanol > Acetone

The maximum desorption percent using a single solvent in the solution at room temperature is about 90%. Combination of organic solvents and elevated solution temperature may increase the carbon desorption efficiency to 92% - 92%. A solution contained 50 - 100 g/L thiourea, 50 - 100 g/L sulphuric acid and 5% butanol may desorb 98% - 99% gold from carbon in 50 bed volume at 40^{0}C or 60^{0}C leaving the residual carbon assayed less than 0.10 mg/g Au.

1.0 M and 2.0 M sodium sulphide solution can completely desorb gold from carbon at room temperature in 30 and 15 bed volume. Higher solution temperature may increase the desorption rate. With 0.5 M sodium sulphide solution at 95^{0} C, more than 98% of gold is eluted from carbon in less than 5 hours. 50 g/L sodium thiosulphate solution may desorb 98% gold from carbon at 50°C in 50 bed volume solution.

The activity of eluted carbon depend on the type of elution systems. The carbon eluted with sodium cyanide-sodium hydroxide solution can be recycled three times before regeneration. The carbon treated with other elution systems have to regeneration after one recycle in the adsorption circuit. The regeneration can be conducted at 700° C or 800° C for 60 minutes. If the retention time reduced to 20 minutes under the same temperature range, the carbon activity can be restored by regeneration twice under the same conditions.

6, APPENDIX

Details of Testing Data

Test No. CA-1 Carbon Adsorption Test

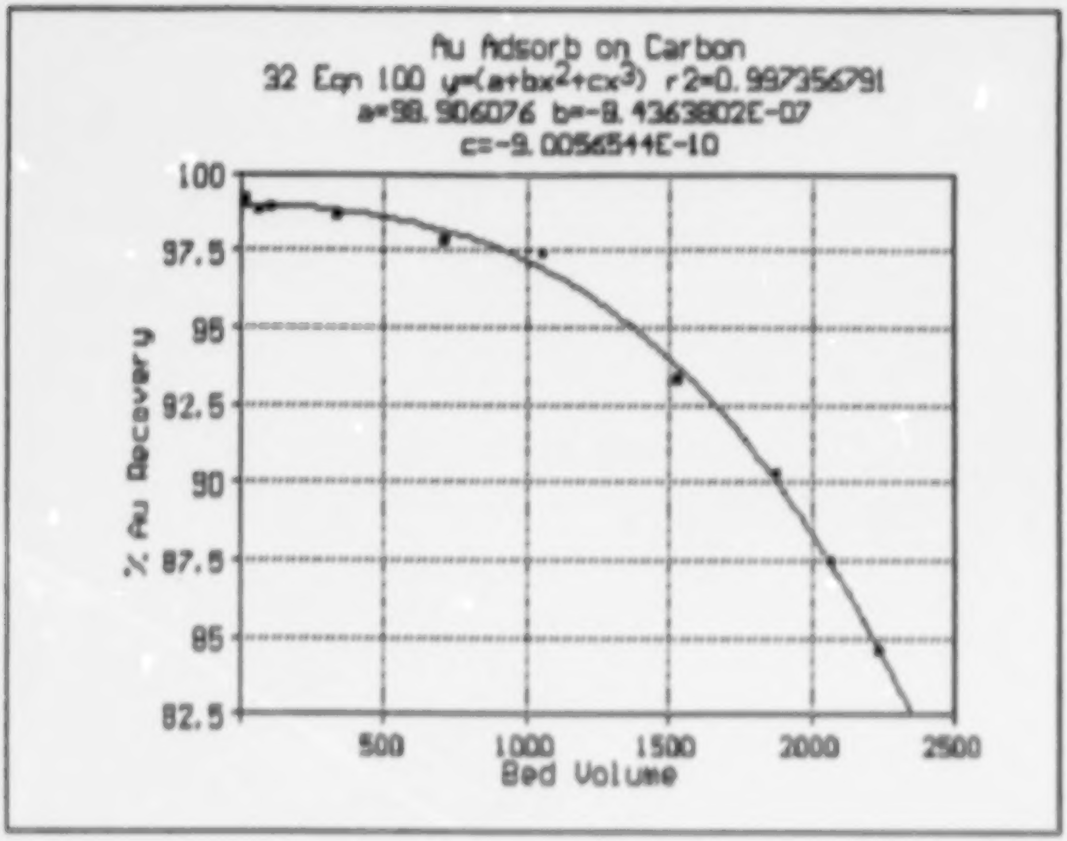
Carbon: Calgon GRC-22, 6x16, 7.0 grams

Solution: Heap Leach Pregnant Solution
Column #4 (from CANMET)
Jan. 22, 1991

Flow Rate: 2 - 3 Bed Volume
((0.6 - 0.7 ml/min.)

Time	Volume, ml		Bed	Barren	% Gold Recovery		Loading
(min.)	Ind.	Cum.	Volume	Au,mg/L	Ind.	Cum.	Au,mg/g
150	100	100	7.1	0.0060	98.84	98.84	0.0073
165	100	200	14.3	0.0030	99.42	99.13	0.0146
145	100	300	21.4	0.0080	98.45	98.90	0.0219
145	100	400	28.6	0.0100	98.07	98.69	0.0292
170	100	500	35.7	0.0080	98.45	98.65	0.0364
130	100	600	42.9	0.0010	99.81	98.84	0.0438
210	135	735	52.5	0.0070	98.65	98.80	0.0536
185	120	855	61.1	0.0050	99.03	98.84	0.0624
170	120	975	69.6	0.0060	98.84	98.84	0.0712
125	102	1077	76.9	0.0050	99.03	98.86	0.0786
375	100	1177	84.1	0.0030	99.42	98.90	0.0860
375	100	1277	91.2	0.0030	99.42	98.94	0.0933
145	102	1379	98.5	0.0060	98.84	98.94	0.1008
170	101	1480	105.7	0.0120	97.68	98.85	0.1081
140	102	1582	113.0	0.0052	98.99	98.86	0.1155
970	770	2352	168.0	0.0110	97.87	98.54	0.1712
425	300	2652	189.4	0.0065	98.74	98.56	0.1931
1500	1060	3712	265.1	0.0045	99.13	98.72	0.2707
1320	955	4667	333.4	0.0075	98.55	98.69	0.3402
1080	750	5417	386.9	0.0063	98.78	98.70	0.3950
1415	1015	6432	459.4	0.0117	97.74	98.55	0.4682
1465	960	7392	528.0	0.0090	98.26	98.51	0.5379
1440	1011	8403	600.2	0.0130	97.49	98.39	0.6107
615	1200	9603	685.9	0.0313	93.95	97.83	0.6940
625	350	9953	710.9	0.0163	96.85	97.80	0.7191
1413	680	10633	759.5	0.0093	98.20	97.82	0.7684
1500	950	11583	827.4	0.0097	98.12	97.85	0.8372
1600	990	12573	898.1	0.0167	96.77	97.76	0.9080
1620	1000	13573	969.5	0.0120	97.68	97.76	0.9802
2000	1200	14773	1055.2	0.0335	93.52	97.41	1.0631
1280	650	15423	1101.6	0.0250	95.17	97.32	1.1088
1060	340	15763	1125.9	0.0290	94.39	97.26	1.1325
1920	900	16663	1190.2	0.0270	94.78	97.12	1.1955
1425	1200	17863	1275.9	0.0900	82.60	96.15	1.2687
1625	1200	19063	1361.6	0.1450	71.96	94.62	1.3325

1660	1200	20263	1447.4	0.0980	81.05	93.82	1.4043
1375	1080	21343	1524.5	0.0810	84.34	93.34	1.4716
1635	970	22313	1593.8	0.0990	80.85	92.80	1.5296
1070	1040	23353	1668.1	0.1540	70.22	91.79	1.5835
1280	1100	24453	1746.6	0.0950	81.63	91.33	1.6498
1760	810	25263	1804.5	0.0760	85.30	91.14	1.7009
1250	950	26213	1872.4	0.1710	66.93	90.26	1.7478
1595	1130	27343	1953.1	0.2030	60.74	89.04	1.7986
1415	910	28253	2018.1	0.2030	60.74	88.13	1.8394
1460	670	28923	2065.9	0.2130	58.81	87.45	1.8685
1440	970	29893	2135.2	0.2520	51.27	86.28	1.9052
1535	1200	31093	2220.9	0.2720	47.40	84.78	1.9472
385	200	31293	2235.2	0.2770	46.43	84.53	1.9541



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Au Adsorb on Carbon                                 Apr 8,1992 8:21 AM
10 Active X-Y Points
X: Bed Volume               Mean: 997.14            SD: 875.2639871
Y: % Au Recovery            Mean: 94.634            SD: 5.424692925

32 Eqn 100 y=(a+bx2+cx3) r2=0.997356791

   Coefficient     Std Error     T(Coef/Err)    95% Confidence Limits
a 98.90607598    0.155074419    637.7974931    98.53793912    99.27421285
b -8.436e-07     3.7301e-07     -2.26168327    -1.729e-06     4.1872e-08
c -9.006e-10     1.7237e-10     -5.22458705    -1.31e-09      -4.914e-10


Curve-Fit Std Error:     0.316237319925
Curve-Fit F-Statistic: 1320.64818817
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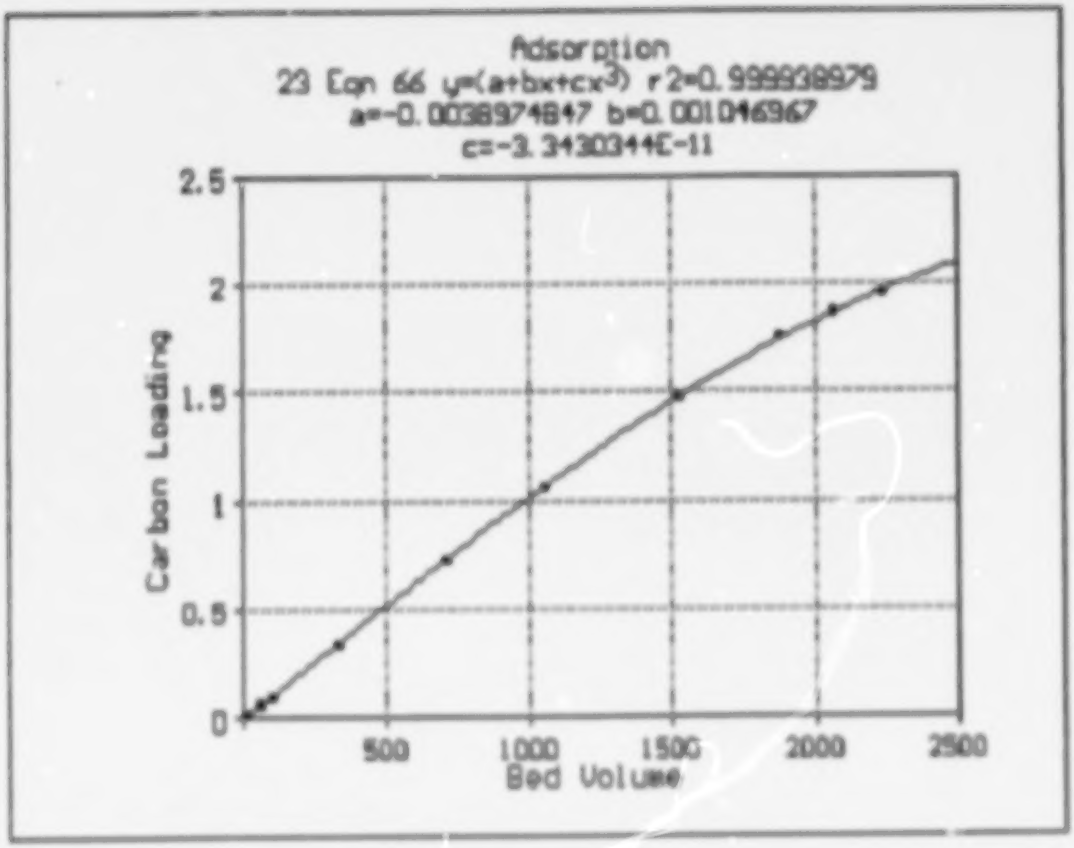

```
Adsorption                                          Apr 8,1992 8:30 AM
10 Active X-Y Points
X: Bed Volume                 Mean: 997.14          SD: 875.2639871
Y: Carbon Loading             Mean: 0.93422         SD: 0.787388821

23 Eqn 66 y=(a+bx+cx3) r2=0.999938979

   Coefficient      Std Error      t(Coef/Err)    95% Confidence Limits
a -0.00389748     0.003948967    -0.98696322    -0.01327208    0.005477112
b 0.001046967     7.1927e-06     145.5600279    0.001029892    0.001064042
c -3.343e-11      1.4962e-12     -22.3437978    -3.698e-11     -2.988e-11


Curve-Fit Std Error:   0.00697432764492
Curve-Fit F-Statistic: 57353.4844888
```

Test No. CA-2 Carbon Adsorption Test

Carbon: Calgon GRC-22, 6x16, 10 grams

Solution: Heap Leach Pregnant Solution
Column #3 (from CANMET)
Jan. 22, 1991

Flow Rate: 2 - 3 Bed Volume
((0.6 - 0.7 ml/min.)

Time (min.)	Volume, ml Ind.	Volume, ml Cum.	Bed Volume	Barren Au,mg/L	% Gold Recovery Ind.	% Gold Recovery Cum.	Loading Au,mg/g
960	1080	1080	54.0	0.0047	98.98	98.98	0.0492
1780	770	1850	92.5	0.0066	98.57	98.81	0.0841
1755	1040	2890	144.5	0.0085	98.15	98.57	0.1310
1510	1000	3890	194.5	0.0071	98.46	98.54	0.1763
1470	940	4830	241.5	0.0057	98.76	98.58	0.2190
1445	910	5740	287.0	0.0093	97.98	98.49	0.2600
1140	640	6380	319.0	0.0130	97.17	98.36	0.2887
1735	1080	7460	373.0	0.0176	96.17	98.04	0.3364
1095	980	8440	422.0	0.0223	95.15	97.71	0.3793
1665	1350	9790	489.5	0.0249	94.59	97.28	0.4381
1455	910	10700	535.0	0.0276	94.00	97.00	0.4774
1515	960	11660	583.0	0.0246	94.65	96.80	0.5192
1185	700	12360	618.0	0.0217	95.28	96.72	0.5499
2370	1350	13710	685.5	0.0191	95.85	96.63	0.6094
1450	700	14410	720.5	0.0165	96.41	96.62	0.6405
1910	840	15250	762.5	0.0197	95.72	96.57	0.6774
1895	730	15980	799.0	0.0230	95.00	96.50	0.7093
1435	855	16835	841.8	0.0260	94.35	96.39	0.7465
1370	870	17705	885.3	0.0290	93.70	96.26	0.7840
1470	910	18615	930.8	0.0257	94.41	96.17	0.8235
1380	790	19405	970.3	0.0225	95.11	96.12	0.8580
1450	800	20205	1010.3	0.0365	92.07	95.96	0.8919
2490	1350	21555	1077.8	0.0505	89.02	95.53	0.9472
1660	850	22405	1120.3	0.0630	86.30	95.18	0.9809
1510	840	23245	1162.3	0.0755	83.59	94.76	1.0132
1550	960	24205	1210.3	0.0852	81.48	94.23	1.0492
1440	980	25185	1259.3	0.0950	79.35	93.65	1.0850
1720	1150	26335	1316.8	0.1087	76.37	92.90	1.1254
1355	900	27235	1361.8	0.1225	73.37	92.25	1.1558
1260	830	28065	1403.3	0.1310	71.52	91.64	1.1831
1455	890	28955	1447.8	0.1400	69.57	90.96	1.2116

Test No. CA-3 Carbon Adsorption Test

Carbon: Calgon GRC-22, 6x16, 10 grams

Solution: Heap Leach Pregnant Solution
Column #2 (from CANMET)
Jan. 22, 1991

Flow Rate: 2 - 3 Bed Volume
((0.6 - 0.7 ml/min.)

Time (min.)	Volume, ml Ind.	Cum.	Bed Volume	Barren Au,mg/L	% Gold Recovery Ind.	Cum.	Loading Au,mg/g
1700	755	755	37.8	0.0070	98.25	90.25	0.0297
1755	990	1745	87.3	0.0050	98.75	85.68	0.0688
1510	970	2715	135.8	0.0027	99.33	85.93	0.1073
1470	930	3645	182.3	0.0020	99.50	86.08	0.1443
1445	876	4521	226.1	0.0026	99.35	86.14	0.1791
1140	560	5081	254.1	0.0033	99.18	86.15	0.2014
1735	1060	6141	307.1	0.0097	97.58	85.93	0.2427
1095	1200	7341	367.1	0.0283	92.93	85.09	0.2873
1665	1350	8691	434.6	0.0200	95.00	84.70	0.3306
1455	930	9621	481.1	0.0190	95.25	84.52	0.3741
1515	960	10581	529.1	0.0180	95.50	84.39	0.4107
1185	710	11291	564.6	0.0236	94.10	84.23	0.4375
2370	1400	12691	634.6	0.0292	92.70	83.83	0.4894
1450	805	13496	674.8	0.0290	92.75	83.64	0.5192
1910	780	14276	713.8	0.0288	92.80	83.48	0.5482
1140	1050	15326	766.3	0.0382	90.45	83.15	0.5862
1095	740	16066	803.3	0.0476	88.10	82.85	0.6123
1435	870	16936	846.8	0.0488	87.80	82.51	0.6428
1370	890	17826	891.3	0.0500	87.50	82.19	0.6740
1470	830	18656	932.8	0.0514	87.15	81.91	0.7029
1380	660	19316	965.8	0.0528	86.80	81.69	0.7258
1510	650	19966	998.3	0.0600	85.00	81.43	0.7479
2490	1050	21016	1050.8	0.0672	83.20	80.98	0.7829
1660	680	21696	1084.8	0.0644	83.90	80.73	0.8057
1510	720	22416	1120.8	0.0616	84.60	80.50	0.8300
1550	960	23376	1168.8	0.0858	78.55	80.00	0.8602
1420	970	24346	1217.3	0.1100	72.50	79.32	0.8883
1720	1150	25496	1274.8	0.1214	69.65	78.48	0.9204
1355	900	26396	1319.8	0.1328	66.80	77.78	0.9444
1260	815	27211	1360.6	0.1354	66.15	77.17	0.9660
1455	880	28091	1404.6	0.1380	65.50	76.54	0.9890
1435	935	29026	1451.3	0.1344	66.40	75.93	1.0139
2400	1520	30546	1527.3	0.1308	67.30	75.07	1.0548

Test No. 1

Conditions: 50 g/L thiourea
50 g/L sulphuric acid
room temperature
Two bed volume per hour

	Volume	Assay, mg/L			% Au Distribution		Gold
	ml	Au	Cu	Fe	Ind.	Cum.	Unit
	54.70	4.03	0.08	0.75	0.31	0.31	0.22
	58.00	4.88	0.09	1.09	0.40	0.72	0.28
	45.00	5.44	0.09	0.78	0.35	1.06	0.24
	41.80	5.42	0.09	0.74	0.32	1.38	0.23
	39.30	5.64	0.08	1.08	0.31	1.70	0.22
	45.70	5.61	0.07	0.98	0.36	2.06	0.26
	47.90	5.60	0.08	0.89	0.38	2.45	0.27
	50.80	2.65	0.08	0.87	0.19	2.64	0.13
Carbon	12.37	5.54		0.18	97.36	100.00	68.53
	12.37	5.69	(mg/g)		100.00		70.39

Test No. 1

Conditions: 50 g/L thiourea
50 g/L sulphuric acid
room temperature
Two bed volume per hour

	Volume	Assay, mg/L			% Fe Distribution		Fe
	ml	Au	Cu	Fe	Ind.	Cum.	Unit
	54.70	4.03	0.08	0.75	1.60	1.60	0.04
	58.00	4.88	0.09	1.09	2.46	4.05	0.06
	45.00	5.44	0.09	0.78	1.37	5.42	0.04
	41.80	5.42	0.09	0.74	1.20	6.62	0.03
	39.30	5.64	0.08	1.08	1.65	8.27	0.04
	45.70	5.61	0.07	0.98	1.74	10.02	0.04
	47.90	5.60	0.08	0.89	1.66	11.67	0.04
	50.80	2.65	0.08	0.87	1.72	13.39	0.04
Carbon	12.37	5.54		0.18	86.61	100.00	2.23
	12.37		(mg/g)	0.21	100.00		2.57

Test No. 2

Conditions: Elution with 100 g/L thiourea & 100 g/L sulphuric acid at room temperature at first 46 BV. 30 deg.C. up to 53 BV. then 40 deg. C. Two bed volume per hour

Volume ml	Assay, mg/L Au	Cu	Fe	% Au Distribution Ind.	Cum.	Gold Unit
41.60	1.76	0.08	10.84	0.09	0.09	0.07
46.40	5.96	0.12	2.29	0.34	0.43	0.28
41.80	7.69	0.12	1.14	0.40	0.83	0.32
47.20	7.88	0.11	1.00	0.46	1.29	0.37
41.70	8.30	0.11	0.94	0.43	1.72	0.35
43.20	8.36	0.10	2.08	0.45	2.17	0.36
39.00	8.35	0.15	2.25	0.40	2.57	0.33
39.70	7.94	0.15	1.51	0.39	2.96	0.32
43.40	8.25	0.12	0.96	0.44	3.40	0.36
44.30	7.85	0.11	0.96	0.43	3.83	0.35
41.00	8.11	0.10	0.84	0.41	4.24	0.33
46.30	7.35	0.08	0.76	0.42	4.66	0.34
38.80	5.60	0.07	0.89	0.27	4.93	0.22
42.60	5.30	0.07	0.87	0.28	5.21	0.23
40.60	5.44	0.07	0.89	0.27	5.49	0.22
42.60	5.43	0.11	1.11	0.29	5.77	0.23
43.00	4.39	0.07	0.90	0.23	6.01	0.19
39.40	4.93	0.08	1.03	0.24	6.25	0.19
40.30	4.33	0.10	1.42	0.22	6.46	0.17
40.60	4.32	0.11	1.05	0.22	6.68	0.18
39.20	4.20	0.42	0.97	0.20	6.88	0.16
40.80	4.24	0.08	0.98	0.21	7.10	0.17
41.20	4.10	0.08	1.13	0.21	7.30	0.17
46.00	4.36	0.07	1.20	0.25	7.55	0.20
41.70	4.21	0.09	1.09	0.22	7.77	0.18
39.40	4.06	0.08	1.41	0.20	7.97	0.16
43.40	4.01	1.08	1.34	0.22	8.18	0.17
39.70	4.10	0.08	1.23	0.20	8.38	0.16
43.20	3.11	0.10	1.10	0.17	8.55	0.13
41.00	3.17	0.09	1.04	0.16	8.71	0.13
45.50	3.04	0.10	0.86	0.17	8.88	0.14
46.00	2.94	0.08	0.75	0.17	9.05	0.14
43.00	2.80	0.09	1.09	0.15	9.20	0.12
41.00	3.03	0.09	0.78	0.15	9.35	0.12
40.80	2.95	0.09	0.74	0.15	9.50	0.12
42.00	3.09	0.08	1.08	0.16	9.66	0.13
41.10	3.10	0.07	0.98	0.16	9.82	0.13
39.70	3.71	0.08	0.89	0.18	10.00	0.15
42.70	3.51	0.08	0.87	0.19	10.19	0.15
69.10	3.53	0.07	1.02	0.30	10.49	0.24
51.50	0.87	0.53	0.63	0.06	10.54	0.04
47.30	2.88	1.87	0.58	0.17	10.71	0.14
48.30	3.15	1.79	0.57	0.19	10.90	0.15

	44.20	3.26	1.56	1.03	0.18	11.08	0.14
	45.20	3.31	1.34	1.04	0.18	11.26	0.15
	40.00	3.34	1.29	1.03	0.17	11.43	0.13
	41.70	4.21	1.68	1.17	0.22	11.64	0.18
	40.40	6.31	1.38	1.15	0.31	11.96	0.25
	42.80	6.30	1.24	1.00	0.33	12.29	0.27
	43.70	6.19	1.23	0.97	0.33	12.63	0.27
	47.00	5.71	1.15	0.85	0.33	12.96	0.27
	41.00	5.64	1.14	1.00	0.29	13.24	0.23
	43.50	5.56	1.05	0.99	0.30	13.54	0.24
	44.80	9.89	1.07	1.02	0.55	14.09	0.44
	44.00	9.76	1.20	1.06	0.53	14.62	0.43
	51.70	8.86	1.09	0.73	0.57	15.19	0.46
	40.10	8.16	1.03	0.74	0.40	15.59	0.33
	39.50	7.88	0.93	0.71	0.38	15.98	0.31
	40.10	7.25	0.89	0.96	0.36	16.33	0.29
	42.00	6.54	0.80	0.96	0.34	16.67	0.27
	51.90	6.50	0.78	1.06	0.42	17.09	0.34
	37.70	4.38	1.04	1.00	0.20	17.29	0.17
	47.30	6.78	0.96	0.91	0.40	17.69	0.32
	41.50	7.17	0.96	0.94	0.37	18.06	0.30
	48.00	6.46	0.82	0.83	0.38	18.44	0.31
	42.80	6.68	0.82	1.35	0.35	18.79	0.29
	44.00	6.66	0.84	1.46	0.36	19.16	0.29
	45.50	3.79	0.70	1.64	0.21	19.37	0.17
	47.20	4.46	0.67	1.39	0.26	19.63	0.21
	44.70	4.36	0.67	1.45	0.24	19.87	0.19
	52.50	4.30	0.64	1.38	0.28	20.15	0.23
Carbon	14.96	4.32	0.09	0.64	79.85	100.00	64.63
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	14.96	5.41	(mg/g)		100.00		80.94

Test No.   2

Conditions: Elution with 100 g/L thiourea & 100 g/L sulphuric
acid at room temperature at first 46 BV.
30 deg.C. up to 53 BV. then 40 deg. C.
Two bed volume per hour

Volume ml	Assay, mg/L Au	Cu	Fe	% Cu Distribution Ind.	Cum.	Cu Unit
41.60	1.76	0.08	10.84	0.11	0.11	0.00
46.40	5.96	0.12	2.29	0.18	0.29	0.01
41.80	7.69	0.12	1.14	0.17	0.46	0.01
47.20	7.88	0.11	1.00	0.17	0.63	0.01
41.70	8.38	0.11	0.94	0.15	0.78	0.00
43.20	8.36	0.10	2.08	0.14	0.92	0.00
39.00	8.35	0.15	2.25	0.19	1.12	0.01
39.70	7.94	0.15	1.51	0.20	1.31	0.01
43.40	8.25	0.12	0.96	0.17	1.49	0.01
44.30	7.85	0.11	0.96	0.16	1.65	0.00
41.00	8.11	0.10	0.84	0.14	1.78	0.00
46.30	7.35	0.08	0.76	0.12	1.90	0.00
38.80	5.60	0.07	0.89	0.09	1.99	0.00
42.60	5.38	0.07	0.87	0.10	2.09	0.00
40.60	5.44	0.07	0.89	0.09	2.19	0.00
42.60	5.43	0.11	1.11	0.15	2.34	0.00
43.00	4.39	0.07	0.90	0.10	2.44	0.00
39.40	4.93	0.08	1.03	0.10	2.54	0.00
40.30	4.33	0.10	1.42	0.13	2.68	0.00
40.60	4.32	0.11	1.05	0.15	2.82	0.00
39.20	4.20	0.42	0.97	0.54	3.37	0.02
40.80	4.24	0.08	0.98	0.11	3.47	0.00
41.20	4.10	0.08	1.13	0.11	3.58	0.00
46.00	4.36	0.07	1.20	0.11	3.69	0.00
41.70	4.21	0.09	1.09	0.12	3.81	0.00
39.40	4.06	0.08	1.41	0.10	3.92	0.00
43.40	4.01	1.08	1.34	1.55	5.46	0.05
39.70	4.10	0.08	1.23	0.10	5.57	0.00
43.20	3.11	0.10	1.10	0.14	5.71	0.00
41.00	3.17	0.09	1.04	0.12	5.83	0.00
45.50	3.04	0.10	0.86	0.15	5.98	0.00
46.00	2.94	0.08	0.75	0.12	6.11	0.00
43.00	2.80	0.09	1.09	0.13	6.23	0.00
41.00	3.03	0.09	0.78	0.12	6.35	0.00
40.80	2.95	0.09	0.74	0.12	6.48	0.00
42.80	3.09	0.08	1.08	0.11	6.59	0.00
41.10	3.10	0.07	0.98	0.09	6.68	0.00
39.70	3.71	0.08	0.89	0.10	6.79	0.00
42.70	3.51	0.08	0.87	0.11	6.90	0.00
69.10	3.53	0.07	1.02	0.16	7.06	0.00
51.50	0.87	0.53	0.63	0.90	7.96	0.03
47.30	2.88	1.87	0.58	2.92	10.88	0.09
48.30	3.15	1.79	0.57	2.85	13.73	0.09

	44.20	3.26	1.56	1.03	2.28	16.01	0.07
	45.20	3.31	1.34	1.04	2.00	18.01	0.06
	40.00	3.34	1.29	1.03	1.70	19.71	0.05
	41.70	4.21	1.68	1.17	2.31	22.02	0.07
	40.40	6.31	1.38	1.15	1.84	23.86	0.06
	42.80	6.30	1.24	1.00	1.75	25.61	0.05
	43.70	6.19	1.23	0.97	1.77	27.39	0.05
	47.00	5.71	1.15	0.85	1.78	29.17	0.05
	41.00	5.64	1.14	1.00	1.54	30.71	0.05
	43.50	5.56	1.05	0.99	1.51	32.22	0.05
	44.80	9.89	1.07	1.02	1.58	33.80	0.05
	44.00	9.76	1.20	1.06	1.74	35.54	0.05
	51.70	8.86	1.09	0.73	1.86	37.40	0.06
	40.10	8.16	1.03	0.74	1.36	38.76	0.04
	39.50	7.88	0.93	0.71	1.21	39.98	0.04
	40.10	7.25	0.89	0.96	1.18	41.15	0.04
	42.00	6.54	0.80	0.96	1.11	42.26	0.03
	51.90	6.50	0.78	1.06	1.34	43.60	0.04
	37.70	4.38	1.04	1.00	1.29	44.89	0.04
	47.30	6.78	0.96	0.91	1.50	46.39	0.05
	41.50	7.17	0.96	0.94	1.31	47.71	0.04
	48.00	6.46	0.82	0.83	1.30	49.00	0.04
	42.80	6.68	0.82	1.35	1.16	50.16	0.04
	44.00	6.66	0.84	1.46	1.22	51.38	0.04
	45.50	3.79	0.70	1.64	1.05	52.43	0.03
	47.20	4.46	0.67	1.39	1.04	53.48	0.03
	44.70	4.36	0.67	1.45	0.99	54.46	0.03
	52.50	4.30	0.64	1.38	1.11	55.57	0.03
Carbon	14.96	4.32	0.09	0.64	44.43	100.00	1.35
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	14.96		0.20	(mg/g)	100.00		3.03

Test No. 2

Conditions: Elution with 100 g/L thiourea & 100 g/L sulphuric
acid at room temperature at first 46 BV.
30 deg.C. up to 53 BV. then 40 deg. C.
Two bed volume per hour

Volume ml	Assay, mg/L Au	 Cu	 Fe	% Fe Distribution Ind.	 Cum.	Fe Unit
41.60	1.76	0.08	10.84	3.39	3.39	0.45
46.40	5.96	0.12	2.29	0.80	4.19	0.11
41.80	7.69	0.12	1.14	0.36	4.55	0.05
47.20	7.88	0.11	1.00	0.36	4.91	0.05
41.70	8.38	0.11	0.94	0.29	5.20	0.04
43.20	8.36	0.10	2.08	0.68	5.88	0.09
39.00	8.35	0.15	2.25	0.66	6.54	0.09
39.70	7.94	0.15	1.51	0.45	6.99	0.06
43.40	8.25	0.12	0.96	0.31	7.30	0.04
44.30	7.85	0.11	0.96	0.32	7.62	0.04
41.00	8.11	0.10	0.84	0.26	7.88	0.03
46.30	7.35	0.08	0.76	0.26	8.15	0.04
38.80	5.60	0.07	0.89	0.26	8.41	0.03
42.60	5.38	0.07	0.87	0.28	8.69	0.04
40.60	5.44	0.07	0.89	0.27	8.96	0.04
42.60	5.43	0.11	1.11	0.36	9.31	0.05
43.00	4.39	0.07	0.90	0.29	9.61	0.04
39.40	4.93	0.08	1.03	0.31	9.91	0.04
40.30	4.33	0.10	1.42	0.43	10.34	0.06
40.60	4.32	0.11	1.05	0.32	10.66	0.04
39.20	4.20	0.42	0.97	0.29	10.95	0.04
40.80	4.24	0.08	0.98	0.30	11.25	0.04
41.20	4.10	0.08	1.13	0.35	11.60	0.05
46.00	4.36	0.07	1.20	0.42	12.02	0.06
41.70	4.21	0.09	1.09	0.34	12.36	0.05
39.40	4.06	0.08	1.41	0.42	12.78	0.06
43.40	4.01	1.08	1.34	0.44	13.21	0.06
39.70	4.10	0.08	1.23	0.37	13.58	0.05
43.20	3.11	0.10	1.10	0.36	13.94	0.05
41.00	3.17	0.09	1.04	0.32	14.26	0.04
45.80	3.04	0.10	0.86	0.29	14.55	0.04
46.00	2.94	0.08	0.75	0.26	14.81	0.03
43.00	2.80	0.09	1.09	0.35	15.17	0.05
41.00	3.03	0.09	0.78	0.24	15.41	0.03
40.80	2.95	0.09	0.74	0.23	15.63	0.03
42.80	3.09	0.08	1.08	0.35	15.98	0.05
41.10	3.10	0.07	0.98	0.30	16.28	0.04
39.70	3.71	0.08	0.89	0.27	16.55	0.04
42.70	3.51	0.08	0.87	0.28	16.83	0.04
69.10	3.53	0.07	1.02	0.53	17.36	0.07
51.50	0.87	0.53	-0.63	0.24	17.61	0.03
47.30	2.88	1.87	0.58	0.21	17.81	0.03
48.30	3.15	1.79	0.57	0.21	18.02	0.03

	44.20	3.26	1.56	1.03	0.34	18.36	0.05
	45.20	3.31	1.34	1.04	0.35	18.72	0.05
	40.00	3.34	1.29	1.03	0.31	19.03	0.04
	41.70	4.21	1.68	1.17	0.37	19.39	0.05
	40.40	6.31	1.38	1.15	0.35	19.74	0.05
	42.80	6.30	1.24	1.00	0.32	20.06	0.04
	43.70	6.19	1.23	0.97	0.32	20.38	0.04
	47.00	5.71	1.15	0.85	0.30	20.68	0.04
	41.00	5.64	1.14	1.00	0.31	20.99	0.04
	43.50	5.56	1.05	0.99	0.32	21.32	0.04
	44.80	9.89	1.07	1.02	0.34	21.66	0.05
	44.00	9.76	1.20	1.06	0.35	22.01	0.05
	51.70	8.86	1.09	0.73	0.28	22.30	0.04
	40.10	8.16	1.03	0.74	0.22	22.52	0.03
	39.50	7.88	0.93	0.71	0.21	22.73	0.03
	40.10	7.25	0.89	0.96	0.29	23.02	0.04
	42.00	6.54	0.80	0.96	0.30	23.32	0.04
	51.90	6.50	0.78	1.06	0.41	23.74	0.06
	37.70	4.38	1.04	1.00	0.28	24.02	0.04
	47.30	6.78	0.96	0.91	0.32	24.34	0.04
	41.50	7.17	0.96	0.94	0.29	24.64	0.04
	48.00	6.46	0.82	0.83	0.30	24.94	0.04
	42.80	6.68	0.82	1.35	0.43	25.37	0.06
	44.00	6.66	0.84	1.46	0.48	25.86	0.06
	45.50	3.79	0.70	1.64	0.56	26.42	0.07
	47.20	4.46	0.67	1.39	0.49	26.91	0.07
	44.70	4.36	0.67	1.45	0.49	27.40	0.06
	52.50	4.30	0.64	1.38	0.55	27.94	0.07
Carbon	14.96	4.32	0.09	0.64	72.06	100.00	9.57
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	14.96		(mg/g)	0.89	100.00		13.29

Test No. 3

Conditions: Wash with 1 M HCl at 70 deg. one hour
Elution with 100 g/L thiourea & 100 g/L
sulphuric acid at 40 deg. C
Two bed volume per hour

Volume ml	Assay, mg/L Au	Cu	Fe	% Au Distribution Ind.	Cum.	Gold Unit
40.60	0.70	0.05	2.90	0.04	0.04	0.03
38.90	2.70	0.07	1.51	0.14	0.18	0.11
41.60	3.61	0.08	1.06	0.20	0.38	0.15
41.80	3.80	0.07	0.79	0.21	0.59	0.16
43.70	3.88	0.08	0.78	0.23	0.82	0.17
40.50	3.95	0.08	0.98	0.21	1.03	0.16
42.00	4.04	0.07	0.82	0.23	1.26	0.17
42.40	4.02	0.07	0.87	0.23	1.49	0.17
40.30	3.92	0.11	0.92	0.21	1.70	0.16
42.30	4.28	0.08	0.85	0.24	1.94	0.18
42.00	3.90	0.10	1.17	0.22	2.16	0.16
38.30	3.91	0.08	1.11	0.20	2.36	0.15
67.00	4.26	0.07	1.40	0.38	2.75	0.29
41.00	4.25	0.07	0.85	0.23	2.98	0.17
37.70	4.32	0.06	0.58	0.22	3.20	0.16
40.60	4.29	0.05	0.57	0.23	3.43	0.17
40.40	4.39	0.06	1.15	0.24	3.67	0.18
41.20	4.12	0.09	1.19	0.23	3.90	0.17
33.40	4.05	0.08	1.03	0.18	4.08	0.14
39.40	4.24	0.07	1.18	0.22	4.30	0.17
37.60	4.21	0.07	1.16	0.21	4.51	0.16
41.20	4.29	0.08	1.05	0.24	4.75	0.18
40.70	4.26	0.07	0.97	0.23	4.98	0.17
43.40	4.32	0.08	0.86	0.25	5.23	0.19
41.30	4.38	0.06	0.98	0.24	5.48	0.18
43.80	4.43	0.07	1.12	0.26	5.74	0.19
44.60	4.24	0.07	1.04	0.25	5.99	0.19
44.20	4.18	0.07	1.01	0.25	6.24	0.18
40.60	4.25	0.07	0.77	0.23	6.47	0.17
43.90	4.21	0.06	0.67	0.25	6.72	0.18
40.90	4.07	0.06	0.65	0.22	6.94	0.17
40.40	4.15	0.07	1.50	0.22	7.16	0.17
40.50	4.17	0.07	0.98	0.23	7.39	0.17
41.40	4.09	0.06	1.32	0.23	7.62	0.17
42.80	4.00	0.14	1.03	0.23	7.85	0.17
44.30	3.93	0.08	1.01	0.23	8.08	0.17
39.30	4.00	0.09	0.97	0.21	8.29	0.16
40.00	3.84	0.07	0.91	0.21	8.50	0.15
42.00	4.06	0.07	0.95	0.23	8.73	0.17
38.00	4.05	0.08	1.48	0.21	8.94	0.16
40.50	3.88	0.08	1.62	0.21	9.15	0.16
42.30	3.85	0.07	1.47	0.22	9.36	0.16
41.00	3.87	0.07	1.50	0.21	9.58	0.16

	43.50	3.86	0.06	1.65	0.22	9.80	0.17
Carbon	13.88	4.85	0.00	0.01	90.20	100.00	67.32
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	13.88	5.38	(mg/g)		100.00		74.63

Test No. 3

Conditions: Wash with 1 M HCl at 70 deg. one hour
Elution with 100 g/L thiourea & 100 g/L
sulphuric acid at 40 deg. C
Two bed volume per hour

Volume	Assay, mg/L			% Cu Distribution		Cu
ml	Au	Cu	Fe	Ind.	Cum.	Unit
200.00	0.00	0.20	3.14	17.29	17.29	0.04
40.60	0.70	0.05	2.90	0.88	18.17	0.00
38.90	2.70	0.07	2.51	1.18	19.34	0.00
41.60	3.61	0.08	1.06	1.44	20.78	0.00
41.80	3.80	0.07	0.79	1.26	22.05	0.00
43.70	3.88	0.08	0.76	1.51	23.56	0.00
40.50	3.95	0.08	0.98	1.40	24.96	0.00
42.00	4.04	0.07	0.82	1.27	26.23	0.00
42.40	4.02	0.07	0.87	1.28	27.51	0.00
40.30	3.92	0.11	0.92	1.92	29.43	0.00
42.30	4.28	0.08	0.85	1.46	30.89	0.00
42.00	3.90	0.10	1.17	1.82	32.71	0.00
38.30	3.91	0.08	1.11	1.32	34.03	0.00
67.00	4.26	0.07	1.40	2.03	36.06	0.00
41.00	4.25	0.07	0.85	1.24	37.30	0.00
37.70	4.32	0.06	0.58	0.98	38.28	0.00
40.60	4.29	0.05	0.57	0.88	39.15	0.00
40.40	4.39	0.06	1.15	1.05	40.20	0.00
41.20	4.12	0.09	1.19	1.60	41.81	0.00
33.40	4.05	0.08	1.03	1.15	42.96	0.00
39.40	4.24	0.07	1.18	1.19	44.15	0.00
37.60	4.21	0.07	1.16	1.14	45.29	0.00
41.20	4.29	0.08	1.05	1.42	46.71	0.00
40.70	4.26	0.07	0.97	1.23	47.95	0.00
43.40	4.32	0.08	0.86	1.50	49.45	0.00
41.30	4.38	0.06	0.98	1.07	50.52	0.00
43.80	4.43	0.07	1.12	1.33	51.84	0.00
44.60	4.24	0.07	1.04	1.35	53.19	0.00
44.20	4.18	0.07	1.01	1.34	54.53	0.00
40.60	4.25	0.07	0.77	1.23	55.76	0.00
43.90	4.21	0.06	0.67	1.14	56.90	0.00
40.90	4.07	0.06	0.65	1.06	57.96	0.00
40.40	4.15	0.07	1.50	1.22	59.18	0.00
40.50	4.17	0.07	0.98	1.23	60.41	0.00
41.40	4.09	0.06	1.32	1.07	61.48	0.00
42.80	4.00	0.14	1.03	2.59	64.07	0.01
44.30	3.93	0.08	1.01	1.53	65.60	0.00
39.30	4.00	0.09	0.97	1.53	67.13	0.00
40.00	3.84	0.07	0.91	1.21	68.34	0.00
42.00	4.06	0.07	0.95	1.27	69.61	0.00
38.80	4.05	0.08	1.48	1.34	70.95	0.00
40.50	3.88	0.08	1.62	1.40	72.35	0.00
42.30	3.85	0.07	1.47	1.28	73.63	0.00

	41.00	3.87	0.07	1.50	1.24	74.87	0.00
	43.50	3.86	0.06	1.65	1.13	76.00	0.00
Carbon	13.88	4.85	0.00	0.01	24.00	100.00	0.06
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	13.88		0.02	(mg/g)	100.00		0.23

Test No. 3

Conditions: Wash with 1 M HCl at 70 deg. one hour
Elution with 100 g/L thiourea & 100 g/L
sulphuric acid at 40 deg. C
Two bed volume per hour

Volume	Assay, mg/L			% Fe Distribution		Fe
ml	Au	Cu	Fe	Ind.	Cum.	Unit
200.00	0.00	0.20	3.14	22.21	22.21	0.63
40.60	0.70	0.05	2.90	4.16	26.38	0.12
38.90	2.70	0.07	2.51	3.45	29.83	0.10
41.60	3.61	0.08	1.06	1.56	31.39	0.04
41.80	3.80	0.07	0.79	1.17	32.56	0.03
43.70	3.88	0.08	0.78	1.21	33.76	0.03
40.50	3.95	0.08	0.98	1.40	35.17	0.04
42.00	4.04	0.07	0.82	1.22	36.39	0.03
42.40	4.02	0.07	0.87	1.30	37.69	0.04
40.30	3.92	0.11	0.92	1.31	39.00	0.04
42.30	4.28	0.08	0.85	1.27	40.27	0.04
42.00	3.90	0.10	1.17	1.74	42.01	0.05
38.30	3.91	0.08	1.11	1.50	43.51	0.04
67.00	4.26	0.07	1.40	3.32	46.83	0.09
41.00	4.25	0.07	0.85	1.23	48.06	0.03
37.70	4.32	0.06	0.58	0.77	48.84	0.02
40.60	4.29	0.05	0.57	0.82	49.66	0.02
40.40	4.39	0.06	1.15	1.64	51.30	0.05
41.20	4.12	0.09	1.19	1.73	53.03	0.05
33.40	4.05	0.08	1.03	1.22	54.25	0.03
39.40	4.24	0.07	1.18	1.64	55.90	0.05
37.60	4.21	0.07	1.16	1.54	57.44	0.04
41.20	4.29	0.08	1.05	1.53	58.97	0.04
40.70	4.26	0.07	0.97	1.40	60.36	0.04
43.40	4.32	0.08	0.86	1.32	61.68	0.04
41.30	4.38	0.06	0.98	1.43	63.12	0.04
43.80	4.43	0.07	1.12	1.74	64.85	0.05
44.60	4.24	0.07	1.04	1.64	66.49	0.05
44.20	4.18	0.07	1.01	1.58	68.07	0.04
40.60	4.25	0.07	0.77	1.11	69.18	0.03
43.90	4.21	0.06	0.67	1.04	70.22	0.03
40.90	4.07	0.06	0.65	0.94	71.16	0.03
40.40	4.15	0.07	1.50	2.14	73.30	0.06
40.50	4.17	0.07	0.98	1.40	74.70	0.04
41.40	4.09	0.06	1.32	1.93	76.64	0.05
42.80	4.00	0.14	1.03	1.56	78.20	0.04
44.30	3.93	0.08	1.01	1.58	79.78	0.04
39.30	4.00	0.09	0.97	1.35	81.13	0.04
40.00	3.84	0.07	0.91	1.29	82.41	0.04
42.00	4.06	0.07	0.95	1.41	83.83	0.04
38.80	4.05	0.08	1.48	2.03	85.86	0.06
40.50	3.88	0.08	1.62	2.32	88.18	0.07
42.30	3.85	0.07	1.47	2.20	90.38	0.06

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            41.00        3.87        0.07        1.50        2.18      92.55        0.06
            43.50        3.86        0.06        1.65        2.54      95.09        0.07
  Carbon    13.88        4.05        0.00        0.01        4.91     100.00        0.14
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            13.88                  (mg/g)        0.20      100.00                   2.83
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Test No.   4

Conditions: 35% Thiourea & 35% Sulphuric Acid
30% Acetone

Two bed volume per hour

	Volume ml	Assay, mg/L Au	Cu	Fe	% Au Distribution Ind.	Cum.	Gold Unit
	37.00	12.52	0.61	7.55	0.52	0.52	0.46
	45.00	67.84	0.88	4.06	3.46	3.98	3.05
	39.80	62.98	0.54	1.21	2.84	6.83	2.51
	45.00	54.88	0.35	0.85	2.80	9.62	2.47
	40.00	50.72	0.60	3.28	2.30	11.92	2.03
	40.00	47.92	0.45	0.52	2.17	14.10	1.92
	40.80	45.12	0.25	0.39	2.09	16.18	1.84
	40.60	40.32	0.21	0.46	1.86	18.04	1.64
	40.20	33.20	0.17	0.36	1.51	19.55	1.33
	40.80	31.84	0.14	0.36	1.47	21.02	1.30
	39.50	29.92	0.10	0.36	1.34	22.36	1.18
	40.90	29.15	0.23	0.95	1.35	23.71	1.19
	40.90	28.99	0.18	0.64	1.34	25.06	1.19
	41.00	28.32	0.11	0.34	1.32	26.37	1.16
	41.30	24.13	0.09	0.34	1.13	27.50	1.00
	40.10	25.76	0.10	0.35	1.17	28.67	1.03
	40.80	21.94	0.09	0.32	1.01	29.69	0.90
	41.20	16.15	0.09	0.32	0.75	30.44	0.67
	40.00	18.94	0.06	0.29	0.86	31.30	0.76
	40.60	16.83	0.07	0.32	0.77	32.07	0.68
	40.20	10.99	0.27	0.97	0.50	32.57	0.44
	44.90	20.64	0.33	0.86	1.05	33.62	0.93
	40.80	20.04	0.30	0.83	0.93	34.55	0.82
	40.20	22.36	0.23	0.82	1.02	35.57	0.90
	40.60	19.36	0.19	0.85	0.89	36.46	0.79
	40.80	16.56	0.17	0.76	0.77	37.23	0.68
	41.20	17.77	0.22	0.67	0.83	38.06	0.73
	41.00	14.10	0.19	0.63	0.66	38.71	0.58
	40.80	12.02	0.15	0.59	0.56	39.27	0.49
	41.00	11.88	0.13	0.50	0.55	39.82	0.49
	40.80	11.35	0.11	0.54	0.52	40.34	0.46
	30.60	10.90	0.16	0.56	0.38	40.72	0.33
Carbon	12.02	4.35	-	-	59.28	100.00	52.31
	12.02	6.88	(mg/g)		100.00		88.24

Test No. 9

Conditions: 50 g/L thiourea & 50 g/L Sulphuri
20% ethanol

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit
	40.40	3.73	0.20	0.20	0.15
	40.80	6.57	0.36	0.56	0.27
	40.90	4.90	0.27	0.82	0.20
	42.90	8.27	0.47	1.29	0.35
	43.20	8.60	0.49	1.78	0.37
	39.90	8.84	0.47	2.25	0.35
	41.80	8.84	0.49	2.74	0.37
	40.90	8.64	0.47	3.21	0.35
	41.90	8.75	0.49	3.70	0.37
	40.80	8.84	0.48	4.17	0.36
	46.50	9.24	0.57	4.74	0.43
	52.30	9.16	0.64	5.38	0.48
	40.70	8.75	0.47	5.85	0.36
	44.50	8.70	0.51	6.36	0.39
	44.20	8.47	0.50	6.86	0.37
	40.50	8.92	0.48	7.34	0.36
	41.80	9.09	0.50	7.84	0.38
	40.10	8.70	0.46	8.31	0.35
	40.10	8.83	0.47	8.77	0.35
	39.80	8.92	0.47	9.25	0.36
	39.60	8.89	0.47	9.71	0.35
	40.10	8.83	0.47	10.18	0.35
	39.90	8.86	0.47	10.65	0.35
	40.20	8.79	0.47	11.12	0.35
	41.30	8.77	0.48	11.60	0.36
	40.10	8.69	0.46	12.06	0.35
	43.10	8.61	0.49	12.55	0.37
	41.50	8.53	0.47	13.02	0.35
	45.90	8.71	0.53	13.55	0.40
	42.10	8.81	0.49	14.04	0.37
	42.80	8.84	0.50	14.54	0.38
	43.50	8.75	0.50	15.05	0.38
	40.80	8.67	0.47	15.52	0.35
Carbon	10.02	6.36	84.48	100.00	63.73
	10.02	7.53	100.00		75.63

Test No. 6

Conditions: 50 g/L thiourea & 50 g/L Sulphuri
20% Acetone

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit
	39.00	11.93	0.60	0.60	0.47
	40.20	9.80	0.50	1.11	0.39
	42.90	8.75	0.48	1.58	0.37
	44.90	8.35	0.48	2.06	0.37
	35.20	8.33	0.37	2.43	0.29
	38.60	7.56	0.37	2.80	0.29
	43.10	7.44	0.41	3.21	0.32
	42.80	6.96	0.38	3.59	0.30
	40.80	6.10	0.32	3.91	0.25
	40.80	7.09	0.37	4.28	0.29
	41.50	6.90	0.36	4.64	0.29
	47.80	6.76	0.41	5.06	0.32
	38.90	6.43	0.32	5.37	0.25
	36.30	6.47	0.30	5.67	0.23
	40.80	6.27	0.33	6.00	0.26
	40.00	5.89	0.30	6.30	0.24
	41.20	6.15	0.32	6.62	0.25
	46.80	6.07	0.36	6.98	0.28
	45.70	5.81	0.34	7.32	0.27
	40.20	5.78	0.30	7.62	0.23
	46.50	5.73	0.34	7.96	0.27
	44.80	5.69	0.32	8.28	0.25
	43.60	5.64	0.31	8.59	0.25
	42.80	5.61	0.31	8.90	0.24
	41.90	5.27	0.28	9.18	0.22
	47.50	5.16	0.31	9.49	0.25
	49.30	5.06	0.32	9.81	0.25
	42.50	5.08	0.27	10.09	0.22
	43.30	5.40	0.30	10.38	0.23
	40.30	5.28	0.27	10.65	0.21
	42.90	4.89	0.27	10.92	0.21
Carbon	11.45	6.11	89.08	100.00	69.96
	11.45 (grams)	6.86 (mg/g)	100.00		78.54

Test No. 7

Conditions: 50 g/L thiourea & 50 g/L Sulphuri
20% Acetonitrile

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit
	40.10	39.00	2.72	2.72	1.56
	39.90	124.70	8.67	11.39	4.98
	41.90	121.40	8.86	20.25	5.09
	43.90	121.10	9.26	29.51	5.32
	40.00	98.00	6.83	36.33	3.92
	38.90	73.40	4.97	41.31	2.86
	41.80	68.40	4.98	46.29	2.86
	43.20	58.80	4.42	50.71	2.54
	43.40	48.00	3.63	54.34	2.08
	41.90	33.50	2.44	56.78	1.40
	42.90	42.00	3.14	59.92	1.80
	42.60	35.30	2.62	62.54	1.50
	41.10	26.90	1.93	64.46	1.11
	37.80	23.50	1.55	66.01	0.89
	36.70	19.20	1.23	67.24	0.70
	39.80	17.60	1.22	68.46	0.70
	40.20	21.50	1.51	69.96	0.86
	38.90	16.90	1.14	71.11	0.66
	37.90	16.30	1.08	72.18	0.62
	41.50	15.80	1.14	73.33	0.66
	40.80	15.20	1.08	74.41	0.62
	41.20	14.50	1.04	75.45	0.60
	40.30	13.20	0.93	76.37	0.53
	40.00	12.60	0.88	77.25	0.50
	41.30	11.78	0.85	78.10	0.49
	39.50	10.62	0.73	78.83	0.42
	41.80	7.39	0.54	79.37	0.31
	40.20	5.05	0.35	79.72	0.20
	40.30	4.27	0.30	80.02	0.17
	40.10	2.26	0.16	80.18	0.09
	40.80	1.89	0.13	80.31	0.08
	40.10	1.05	0.07	80.39	0.04
Carbon	9.01	1.25	19.61	100.00	11.26
	9.01 (grams)	6.37 (mg/g)	100.00		57.42

Test No. 8

Conditions: 50 g/L thiourea & 50 g/L Sulphuri
10% Butanol & 10% Acetone

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit
	40.20	152.40	4.53	4.53	6.13
	39.80	285.00	8.39	12.92	11.34
	40.80	444.20	13.40	26.32	18.12
	39.50	456.80	13.34	39.66	18.04
	41.60	258.70	7.96	47.62	10.76
	39.80	198.60	5.84	53.46	7.90
	40.90	173.50	5.25	58.71	7.10
	40.30	148.40	4.42	63.13	5.98
	40.80	132.90	4.01	67.14	5.42
	42.90	110.80	3.51	70.65	4.75
	39.50	105.70	3.09	73.74	4.18
	41.70	95.20	2.94	76.68	3.97
	40.10	88.40	2.62	79.30	3.54
	39.50	65.30	1.91	81.21	2.58
	39.80	54.90	1.62	82.82	2.19
	41.20	49.50	1.51	84.33	2.04
	41.90	41.80	1.30	85.62	1.75
	40.80	39.20	1.18	86.81	1.60
	41.30	37.50	1.15	87.95	1.55
	40.90	35.90	1.09	89.04	1.47
	39.50	34.57	1.01	90.05	1.37
	40.80	20.42	0.62	90.66	0.83
	39.80	13.56	0.40	91.06	0.54
	41.20	8.15	0.25	91.31	0.34
	44.80	7.47	0.25	91.56	0.33
	39.60	6.25	0.18	91.74	0.25
	40.20	5.61	0.17	91.91	0.23
	42.80	4.93	0.16	92.06	0.21
	41.70	4.37	0.13	92.20	0.18
	40.30	16.26	0.48	92.68	0.66
	39.90	10.56	0.31	92.99	0.42
Carbon	15.79	0.60	7.01	100.00	9.47
	15.79 (grams)	8.57 (mg/g)	100.00		135.24

Test No. 9

Conditions: 50 g/L thiourea & 50 g/L Sulphuric acid
10% Acetonitrile

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	40.90	4.39	0.13	0.13	0.18	2.00
	43.40	11.85	0.37	0.50	0.51	4.00
	42.70	14.16	0.44	0.94	0.60	6.00
	42.30	15.00	0.46	1.39	0.63	8.00
	41.20	15.68	0.47	1.86	0.65	10.00
	43.80	15.40	0.49	2.34	0.67	12.00
	40.30	15.45	0.45	2.79	0.62	14.00
	40.80	16.40	0.48	3.27	0.67	16.00
	43.60	16.84	0.53	3.80	0.73	18.00
	40.80	16.57	0.49	4.29	0.68	20.00
	42.80	16.29	0.50	4.79	0.70	22.00
	41.90	15.70	0.47	5.27	0.66	24.00
	41.30	15.76	0.47	5.74	0.65	26.00
	46.90	15.84	0.54	6.27	0.74	28.00
	45.80	15.49	0.51	6.78	0.71	30.00
	43.20	15.48	0.48	7.26	0.67	32.00
	40.10	15.59	0.45	7.71	0.63	34.00
	41.30	14.14	0.42	8.13	0.58	36.00
	42.50	13.38	0.41	8.54	0.57	38.00
Wash	70.00	5.67	0.29	8.83	0.40	
Carbon	10.39	12.18	91.17	100.00	126.55	
	10.39 (grams)	13.36 (mg/g)	100.00		138.81	

Test No. 10

Conditions: 50 g/L thiourea & 50 g/L Sulphuric acid
5% Acetonitrile

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	41.20	1.52	0.04	0.04	0.06	2.00
	43.40	4.19	[illegible]	0.17	0.18	4.00
	43.60	4.49	[illegible]	0.31	0.20	6.00
	41.80	4.58	0.13	0.44	0.19	8.00
	40.50	4.65	0.13	0.57	0.19	10.00
	41.50	4.74	0.14	0.71	0.20	12.00
	40.80	4.80	0.14	0.84	0.20	14.00
	41.30	4.81	0.14	0.98	0.20	16.00
	41.80	4.73	0.14	1.12	0.20	18.00
	40.50	4.90	0.14	1.26	0.20	20.00
	41.80	4.53	0.13	1.39	0.19	22.00
	41.40	4.46	0.13	1.52	0.18	24.00
	40.20	4.48	0.13	1.64	0.18	26.00
	42.80	4.47	0.13	1.77	0.19	28.00
	41.60	4.46	0.13	1.90	0.19	30.00
	39.80	4.48	0.12	2.03	0.18	32.00
	41.20	4.46	0.13	2.15	0.18	34.00
	40.70	4.32	0.12	2.28	0.18	36.00
	49.80	4.31	0.15	2.42	0.21	38.00
Wash	72.00	1.97	0.10	2.52	0.14	
Carbon	11.11	12.63	97.48	100.00	140.32	
	11.11 (grams)	12.96 (mg/g)	100.00		143.95	

Test No. 11

Conditions: 25 g/L Thiourea & 50 g/L Sulphuric Acid
10% Acetonirile

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	41.50	5.70	0.17	0.17	0.24	2.00
	49.80	30.20	1.09	1.26	1.50	4.00
	45.10	50.30	1.64	2.90	2.27	6.00
	47.30	57.70	1.97	4.87	2.73	8.00
	44.90	62.00	2.01	6.88	2.78	10.00
	47.50	54.00	1.85	8.73	2.57	12.00
	49.50	63.70	2.28	11.01	3.15	14.00
	46.60	66.60	2.24	13.25	3.10	16.00
	43.80	62.50	1.98	15.23	2.74	18.00
	41.50	79.12	2.37	17.60	3.28	20.00
	42.60	64.49	1.99	19.59	2.75	22.00
	47.10	7.05	0.24	19.83	0.33	24.00
	45.60	4.82	0.16	19.99	0.22	26.00
	46.50	3.90	0.13	20.12	0.18	28.00
	46.20	3.93	0.13	20.25	0.18	30.00
	44.30	4.05	0.13	20.38	0.18	32.00
	40.90	4.16	0.12	20.50	0.17	34.00
Wash	58.80	0.77	0.03	20.54	0.05	
Carbon	9.98	11.02	79.46	100.00	109.98	
	9.98 (grams)	13.87 (mg/g)	100.00		138.40	

Test No. 12

Conditions: 25 g/L thiourea & 50 g/L sulphuric acid
5% Acetonitrile

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	42.80	0.87	0.11	0.11	0.04	2.00
	52.90	0.93	0.15	0.26	0.05	4.00
	40.30	0.97	0.12	0.37	0.04	6.00
	40.10	1.05	0.13	0.50	0.04	8.00
	42.70	1.13	0.14	0.64	0.05	10.00
	40.20	0.98	0.12	0.76	0.04	12.00
	42.10	0.95	0.12	0.88	0.04	14.00
	43.10	0.93	0.12	1.00	0.04	16.00
	41.80	1.54	0.19	1.19	0.06	18.00
	42.60	2.04	0.26	1.45	0.09	20.00
	48.00	2.09	0.30	1.75	0.10	22.00
	40.30	2.12	0.25	2.00	0.09	24.00
	40.10	2.06	0.25	2.25	0.08	26.00
	40.30	2.09	0.25	2.50	0.08	28.00
	45.00	2.26	0.30	2.80	0.10	30.00
	40.30	2.52	0.30	3.11	0.10	32.00
	40.80	2.39	0.29	3.40	0.10	34.00
	41.50	2.32	0.29	3.68	0.10	36.00
	41.40	2.19	0.27	3.95	0.09	38.00
Wash	88.80	1.13	0.30	4.25	0.10	
Carbon	9.89	3.25	95.75	100.00	32.14	
	9.89 (grams)	3.39 (mg/g)	100.00		33.57	

Test No. 13

Conditions: 30 g/L Thiourea & 50 g/L Sulphuric Acid
5% Butanol

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	51.30	36.91	1.22	1.22	1.89	2.00
	41.20	386.20	10.21	11.43	15.91	4.00
	40.50	377.50	9.81	21.24	15.29	6.00
	43.10	301.70	8.34	29.58	13.00	8.00
	40.70	251.90	6.58	36.16	10.25	10.00
	41.50	219.50	5.85	42.00	9.11	12.00
	41.80	322.50	8.65	50.65	13.48	14.00
	41.20	283.60	7.50	58.15	11.68	16.00
	43.00	181.40	5.01	63.16	7.80	18.00
	40.80	124.10	3.25	66.41	5.06	20.00
	40.20	97.94	2.53	68.93	3.94	22.00
	40.80	92.95	2.43	71.37	3.79	24.00
	45.60	92.20	2.70	74.06	4.20	26.00
	43.20	98.32	2.73	76.79	4.25	28.00
	40.60	83.35	2.17	78.96	3.38	30.00
	40.10	59.85	1.54	80.50	2.40	32.00
	40.40	38.50	1.00	81.50	1.56	34.00
Wash	77.90	1.67	0.08	81.58	0.13	
Carbon	10.75	2.67	18.42	100.00	28.70	
	10.75 (grams)	14.50 (mg/g)	100.00		155.84	

Test No. 14

Conditions: 75 g/L Thiourea & 50 g/L Sulphuric Acid
10% Acetonirile

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	45.80	3.16	0.37	0.37	0.14	2.00
	41.20	7.28	0.77	1.14	0.30	4.00
	45.80	7.75	0.91	2.05	0.35	6.00
	44.60	7.36	0.84	2.89	0.33	8.00
	42.90	6.75	0.74	3.63	0.29	10.00
	39.90	6.98	0.71	4.34	0.28	12.00
	40.80	6.70	0.70	5.04	0.27	14.00
	42.90	6.07	0.67	5.71	0.26	16.00
	40.60	6.23	0.65	6.36	0.25	18.00
	42.60	5.58	0.61	6.97	0.24	20.00
	45.00	5.15	0.59	7.56	0.23	22.00
	43.20	5.47	0.61	8.16	0.24	24.00
	39.70	5.32	0.54	8.70	0.21	26.00
	39.80	5.20	0.53	9.23	0.21	28.00
	41.60	5.08	0.54	9.78	0.21	30.00
	45.10	4.85	0.56	10.34	0.22	32.00
	40.10	5.05	0.52	10.85	0.20	34.00
	45.20	4.96	0.57	11.43	0.22	36.00
	43.20	4.39	0.49	11.91	0.19	38.00
Wash	55.40	2.91	0.41	12.33	0.16	
Carbon	9.33	3.67	87.67	100.00	34.24	
	9.33	4.19	100.00		39.06	
	(grams)	(mg/g)				

Test No. 15

Conditions: 35 g/L Thiourea & 50 g/L Sulphuric Acid
10% Acetonirile

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	43.50	1.16	0.14	0.14	0.05	2.00
	42.10	3.57	0.41	0.54	0.15	4.00
	42.30	4.62	0.53	1.07	0.20	6.00
	42.80	4.72	0.55	1.62	0.20	8.00
	43.60	4.54	0.54	2.16	0.20	10.00
	45.80	4.42	0.55	2.71	0.20	12.00
	39.80	4.29	0.46	3.17	0.17	14.00
	41.30	4.24	0.47	3.64	0.18	16.00
	44.20	4.22	0.51	4.15	0.19	18.00
	40.00	3.60	0.39	4.54	0.14	20.00
	46.00	3.65	0.46	4.99	0.17	22.00
	65.30	3.91	0.69	5.69	0.26	24.00
	42.90	3.84	0.45	6.13	0.16	26.00
	42.30	3.88	0.44	6.58	0.16	28.00
	45.20	3.96	0.49	7.06	0.18	30.00
	45.30	3.31	0.41	7.47	0.15	32.00
	42.30	3.20	0.37	7.84	0.14	34.00
	40.20	3.19	0.35	8.18	0.13	36.00
	42.50	2.83	0.33	8.51	0.12	38.00
Wash	55.40	2.11	0.32	8.83	0.12	
Carbon	8.97	3.75	91.17	100.00	33.64	
	8.97	4.11	100.00		36.89	
	(grams)	(mg/g)				

Test No. 16

Conditions: 15 g/L Thiourea & 50 g/L Sulphuric Acid
10% Acetonirile

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.50	1.07	0.13	0.13	0.04	2.00
	40.30	2.65	0.32	0.45	0.11	4.00
	43.40	3.87	0.50	0.94	0.17	6.00
	41.80	4.24	0.53	1.47	0.18	8.00
	49.50	4.39	0.64	2.11	0.22	10.00
	43.20	4.30	0.55	2.02	0.19	12.00
	46.80	4.23	0.59	2.61	0.20	14.00
	45.20	4.14	0.56	3.16	0.19	16.00
	44.90	4.01	0.53	3.70	0.18	18.00
	49.30	3.87	0.57	4.26	0.19	20.00
	35.80	3.05	0.32	4.59	0.11	22.00
	37.90	2.95	0.33	4.92	0.11	24.00
	50.80	3.25	0.49	5.41	0.17	26.00
	43.60	3.12	0.40	5.81	0.14	28.00
	40.20	3.14	0.37	6.19	0.13	30.00
	42.80	3.23	0.41	6.60	0.14	32.00
	46.32	3.26	0.45	7.04	0.15	34.00
	45.80	3.27	0.44	7.49	0.15	36.00
	45.20	3.24	0.43	7.92	0.15	38.00
	40.60	3.02	0.36	8.29	0.12	40.00
Wash	60.30	2.29	0.41	8.69	0.14	
Carbon	7.96	3.84	90.66	99.36	30.57	
	7.96 (grams)	4.24 (mg/g)	100.00		33.72	

Test No. 17

Conditions: 15 g/L Thiourea & 50 g/L Sulphuric Acid
5% Butanol
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	39.80	9.50	0.93	0.93	0.38	2.00
	40.80	21.33	2.13	3.06	0.87	4.00
	39.30	34.21	3.30	6.36	1.34	6.00
	45.80	112.90	12.69	19.05	5.17	8.00
	40.30	98.40	9.73	28.77	3.97	10.00
	42.80	84.40	8.86	37.64	3.61	12.00
	43.80	64.90	6.97	44.61	2.84	14.00
	40.30	51.10	5.05	49.66	2.06	16.00
	43.90	40.50	4.36	54.02	1.78	18.00
	47.50	36.46	4.25	58.27	1.73	20.00
	40.30	36.10	3.57	61.84	1.45	22.00
	40.20	32.16	3.17	65.01	1.29	24.00
	43.20	28.55	3.03	68.04	1.23	26.00
	40.70	27.91	2.79	70.83	1.14	28.00
	42.60	27.59	2.88	73.71	1.18	30.00
	39.60	24.23	2.35	76.06	0.96	32.00
	46.80	17.94	2.06	78.12	0.84	34.00
	44.80	10.97	1.21	79.33	0.49	36.00
	51.30	8.46	1.06	80.39	0.43	38.00
	41.60	7.11	0.73	81.12	0.30	40.00
	44.30	6.66	0.72	81.84	0.30	42.00
	41.80	6.87	0.70	82.55	0.29	44.00
	47.20	6.49	0.75	83.30	0.31	46.00
	44.80	7.54	0.83	84.13	0.34	48.00
	41.60	6.76	0.69	84.82	0.28	50.00
	43.60	4.24	0.45	85.27	0.18	52.00
	41.90	3.92	0.40	85.67	0.16	54.00
	58.90	3.00	0.43	86.11	0.18	56.00
	46.10	2.54	0.29	86.39	0.12	58.00
	41.90	2.34	0.24	86.64	0.10	60.00
	41.50	2.30	0.23	86.87	0.10	62.00
	41.80	2.16	0.22	87.09	0.09	64.00
	49.50	2.13	0.26	87.35	0.11	66.00
	40.90	2.41	0.24	87.59	0.10	68.00
	41.50	2.36	0.24	87.83	0.10	70.00
	40.30	2.14	0.21	88.04	0.09	72.00
	40.20	1.99	0.20	88.24	0.08	74.00
	40.10	1.82	0.18	88.42	0.07	76.00
	47.00	1.28	0.15	88.57	0.06	78.00
Wash	85.00	0.92	0.19	88.76	0.08	
Carbon	9.75	0.47	11.24	100.00	4.58	
	9.75 (grams)	4.18 (mg/g)	100.00	-	40.76	

Test No. 18

Conditions: 30 g/L Thiourea & 50 g/L Sulphuric Acid
5% Butanol
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	38.50	20.83	1.85	1.85	0.80	2.00
	39.80	24.52	2.25	4.11	0.98	4.00
	40.20	34.54	3.21	7.32	1.39	6.00
	49.80	139.80	16.09	23.40	6.96	8.00
	39.70	89.10	8.17	31.57	3.54	10.00
	45.00	73.00	7.59	39.16	3.29	12.00
	51.00	68.50	8.07	47.24	3.49	14.00
	45.70	59.30	6.26	53.50	2.71	16.00
	40.30	51.20	4.77	58.26	2.06	18.00
	44.70	42.50	4.39	62.65	1.90	20.00
	39.70	30.89	2.83	65.49	1.23	22.00
	41.50	27.59	2.65	68.13	1.14	24.00
	45.40	25.93	2.72	70.85	1.18	26.00
	41.80	24.69	2.38	73.24	1.03	28.00
	45.30	24.54	2.57	75.81	1.11	30.00
	45.80	28.29	2.99	78.80	1.30	32.00
	45.30	18.25	1.91	80.71	0.83	34.00
	38.90	12.97	1.17	81.87	0.50	36.00
	46.20	8.83	0.94	82.82	0.41	38.00
	41.90	7.03	0.68	83.50	0.29	40.00
	42.90	6.39	0.63	84.13	0.27	42.00
	40.50	6.59	0.62	84.75	0.27	44.00
	45.90	6.50	0.69	85.44	0.30	46.00
	40.50	7.45	0.70	86.13	0.30	48.00
	40.30	6.64	0.62	86.75	0.27	50.00
	42.80	4.53	0.45	87.20	0.19	52.00
	44.60	3.51	0.36	87.56	0.16	54.00
	42.80	2.88	0.28	87.85	0.12	56.00
	47.90	2.48	0.27	88.12	0.12	58.00
	41.90	2.19	0.21	88.33	0.09	60.00
	41.80	2.04	0.20	88.53	0.09	62.00
	42.00	1.94	0.19	88.72	0.08	64.00
	49.60	1.87	0.21	88.93	0.09	66.00
	40.00	2.27	0.21	89.14	0.09	68.00
	42.60	1.94	0.19	89.33	0.08	70.00
	41.20	1.85	0.18	89.51	0.08	72.00
	53.00	1.53	0.19	89.70	0.08	74.00
	41.30	1.37	0.13	89.83	0.06	76.00
	40.00	1.26	0.12	89.94	0.05	78.00
	40.00	1.18	0.11	90.05	0.05	80.00
Wash	50.00	0.65	0.08	90.13	0.03	
Carbon	9.71	0.44	9.87	100.00	4.27	
	9.71 (grams)	4.46 (mg/g)	100.00		43.28	

Test No. 19

Conditions: 50 g/L Thiourea & 50 g/L Sulphuric Acid
5% Butanol
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	42.50	28.61	3.23	3.23	1.22	2.00
	44.50	43.38	5.13	8.36	1.93	4.00
	40.50	68.00	7.31	15.67	2.75	6.00
	49.50	67.00	8.81	24.48	3.32	8.00
	40.20	63.75	6.81	31.28	2.56	10.00
	43.20	59.25	6.80	38.08	2.56	12.00
	43.50	51.00	5.89	43.97	2.22	14.00
	40.80	40.75	4.42	48.39	1.66	16.00
	40.90	39.25	4.26	52.65	1.61	18.00
	45.00	37.75	4.51	57.16	1.70	20.00
	40.00	32.42	3.44	60.60	1.30	22.00
	40.80	29.35	3.18	63.79	1.20	24.00
	43.80	25.47	2.96	66.75	1.12	26.00
	40.20	29.73	3.17	69.92	1.20	28.00
	41.50	25.27	2.78	72.71	1.05	30.00
	40.30	23.46	2.51	75.22	0.95	32.00
	41.60	20.13	2.22	77.44	0.84	34.00
	44.30	12.24	1.44	78.88	0.54	36.00
	43.40	8.61	0.99	79.87	0.37	38.00
	40.20	7.22	0.77	80.64	0.29	40.00
	40.30	6.69	0.72	81.36	0.27	42.00
	40.10	6.00	0.64	82.00	0.24	44.00
	58.50	6.35	0.99	82.99	0.37	46.00
	45.20	6.29	0.76	83.74	0.28	48.00
	51.20	5.25	0.71	84.45	0.27	50.00
	41.80	3.75	0.42	84.87	0.16	52.00
	40.90	3.39	0.37	85.24	0.14	54.00
	40.80	2.99	0.32	85.56	0.12	56.00
	44.30	2.74	0.32	85.89	0.12	58.00
	39.90	2.53	0.27	86.15	0.10	60.00
	40.80	2.37	0.26	86.41	0.10	62.00
	39.90	2.14	0.23	86.64	0.09	64.00
	49.80	2.11	0.28	86.92	0.11	66.00
	43.20	1.87	0.21	87.13	0.08	68.00
	44.10	1.56	0.18	87.31	0.07	70.00
	40.80	1.52	0.16	87.48	0.06	72.00
	39.80	1.19	0.13	87.60	0.05	74.00
	45.10	1.16	0.14	87.74	0.05	76.00
	40.30	1.11	0.12	87.86	0.04	78.00
	45.10	0.93	0.11	87.97	0.04	80.00
Wash	85.60	0.39	0.09	88.06	0.03	
Carbon	9.99	0.45	11.94	100.00	4.50	
	9.99	3.77	100.00		37.66	
	(grams)	(mg/g)				

Test No. 20

Conditions: 75 g/L Thiourea & 50 g/L Sulphuric Acid
5% Butanol

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	40.10	8.24	0.89	0.89	0.33	2.00
	42.00	42.90	4.83	5.72	1.80	4.00
	48.60	65.50	8.54	14.25	3.18	6.00
	44.10	98.20	11.61	25.87	4.33	8.00
	45.00	78.70	9.50	35.36	3.54	10.00
	42.10	64.40	7.27	42.63	2.71	12.00
	51.20	53.80	7.39	50.02	2.75	14.00
	43.10	58.90	6.81	56.83	2.54	16.00
	44.80	53.00	6.37	63.19	2.37	18.00
	42.10	35.26	3.98	67.17	1.48	20.00
	40.20	34.19	3.69	70.86	1.37	22.00
	46.50	25.87	3.23	74.08	1.20	24.00
	38.20	25.41	2.60	76.69	0.97	26.00
	41.80	24.17	2.71	79.40	1.01	28.00
	42.40	13.32	1.51	80.91	0.56	30.00
	42.60	11.60	1.33	82.24	0.49	32.00
	54.00	8.04	1.16	83.40	0.43	34.00
	49.20	7.73	1.02	84.42	0.38	36.00
	43.60	7.68	0.90	85.32	0.33	38.00
	50.80	7.32	1.00	86.31	0.37	40.00
	41.20	7.97	0.88	87.19	0.33	42.00
	41.20	6.18	0.68	87.88	0.25	44.00
	45.10	5.68	0.69	88.56	0.26	46.00
	44.10	4.25	0.50	89.07	0.19	48.00
	41.50	3.56	0.40	89.46	0.15	50.00
	41.30	3.18	0.35	89.82	0.13	52.00
	40.10	2.86	0.31	90.12	0.11	54.00
	40.20	2.53	0.27	90.40	0.10	56.00
	47.30	2.27	0.29	90.68	0.11	58.00
Wash	42.30	1.97	0.22	90.91	0.08	60.00
Carbon	9.42	0.36	9.09	100.00	3.39	
	9.42 (grams)	3.96 (mg/g)	100.00		37.29	

Test No. 21

Conditions: 50 g/L Thiourea $ 50 g/L Sulphuric Acid
5% Butanol & 10% Acetonitrile

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	41.80	30.68	3.37	3.37	1.28	2.00
	40.20	97.70	10.32	13.70	3.93	4.00
	51.90	114.10	15.57	29.26	5.92	6.00
	47.30	85.30	10.61	39.87	4.03	8.00
	46.30	63.90	7.78	47.64	2.96	10.00
	42.40	54.40	6.06	53.71	2.31	12.00
	44.80	38.78	4.57	58.27	1.74	14.00
	40.30	24.73	2.62	60.89	1.00	16.00
	56.50	22.68	3.37	64.26	1.28	18.00
	43.60	21.45	2.46	66.72	0.94	20.00
	41.60	22.51	2.46	69.18	0.94	22.00
	44.80	21.32	2.51	71.69	0.96	24.00
	58.90	22.94	3.55	75.25	1.35	26.00
	38.70	20.97	2.13	77.38	0.81	28.00
	41.80	14.93	1.64	79.02	0.62	30.00
	43.20	11.98	1.36	80.38	0.52	32.00
	53.00	10.11	1.41	81.79	0.54	34.00
	47.20	8.73	1.08	82.87	0.41	36.00
	41.00	8.84	0.95	83.82	0.36	38.00
	39.80	8.26	0.86	84.69	0.33	40.00
	40.30	7.66	0.81	85.50	0.31	42.00
	40.50	7.85	0.84	86.34	0.32	44.00
	48.50	7.40	0.94	87.28	0.36	46.00
	47.20	5.21	0.65	87.93	0.25	48.00
	40.30	4.89	0.52	88.44	0.20	50.00
	52.80	3.89	0.54	88.98	0.21	52.00
	45.80	3.47	0.42	89.40	0.16	54.00
	40.30	3.39	0.36	89.76	0.14	56.00
	40.00	3.25	0.34	90.10	0.13	58.00
Wash	43.20	1.93	0.22	90.32	0.08	60.00
Carbon	9.69	0.38	9.68	100.00	3.68	
	9.69 (grams)	3.93 (mg/g)	100.00		38.04	

Test No. 22

Conditions: 50 g/L Thiourea $ 50 g/L Sulphuric Acid
5% Butanol & 10% Acetonitrile

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	44.10	25.64	3.34	3.34	1.13	2.00
	43.20	126.20	16.11	19.45	5.45	4.00
	45.30	103.10	13.80	33.25	4.67	6.00
	42.60	106.50	13.40	46.65	4.54	8.00
	41.60	96.20	11.82	58.47	4.00	10.00
	44.30	33.95	4.44	62.92	1.50	12.00
	41.50	29.76	3.65	66.56	1.24	14.00
	40.80	24.60	2.97	69.53	1.00	16.00
	45.60	24.30	3.27	72.80	1.11	18.00
	42.30	22.89	2.86	75.66	0.97	20.00
	41.90	20.99	2.60	78.26	0.88	22.00
	46.90	14.55	2.02	80.28	0.68	24.00
	43.60	11.68	1.50	81.78	0.51	26.00
	38.90	10.85	1.25	83.03	0.42	28.00
	60.30	9.18	1.64	84.66	0.55	30.00
	45.80	8.92	1.21	85.87	0.41	32.00
	59.80	8.49	1.50	87.37	0.51	34.00
	40.80	7.62	0.92	88.29	0.31	36.00
	43.60	6.45	0.83	89.12	0.28	38.00
	43.80	5.26	0.68	89.80	0.23	40.00
	44.30	4.96	0.65	90.45	0.22	42.00
	40.90	4.43	0.54	90.99	0.18	44.00
	41.10	3.72	0.45	91.44	0.15	46.00
	39.80	3.04	0.36	91.80	0.12	48.00
	44.00	2.90	0.38	92.17	0.13	50.00
	44.10	2.25	0.29	92.47	0.10	52.00
Wash	40.10	1.29	0.15	92.62	0.05	54.00
Carbon	8.06	0.31	7.38	100.00	2.50	
	8.06 (grams)	4.20 (mg/g)	100.00		33.85	

Test No. 23

Conditions: 30 g/L Thiourea & 50 g/L Sulphuric Acid
5% Butanol

Two bed volume per hour ; 40 degree C.

	Volume ml	Assay Au, mg/L	% Distribution Ind.	Cum.	Metal Unit	B.V. cum.
	42.00	18.50	1.94	1.94	0.78	2.00
	40.30	196.10	19.72	21.66	7.90	4.00
	40.10	278.90	27.91	49.58	11.18	6.00
	61.30	117.90	18.04	67.61	7.23	8.00
	41.30	67.80	6.99	74.60	2.80	10.00
	40.00	39.70	3.96	78.57	1.59	12.00
	42.30	17.42	1.84	80.40	0.74	14.00
	41.60	11.82	1.23	81.63	0.49	16.00
	41.20	10.65	1.10	82.73	0.4[illegible]	18.00
	41.80	8.53	0.89	83.62	0.36	20.00
	41.90	7.46	0.78	84.40	0.31	22.00
	41.50	5.16	0.53	84.93	0.21	24.00
	40.50	4.62	0.47	85.40	0.19	26.00
	40.20	3.80	0.38	85.78	0.15	28.00
	43.20	4.23	0.46	86.24	0.18	30.00
	40.10	3.47	0.35	86.58	0.14	32.00
	40.30	4.28	0.43	87.01	0.17	34.00
	45.00	3.82	0.43	87.44	0.17	36.00
	55.50	2.92	0.40	87.85	0.16	38.00
	55.00	3.00	0.41	88.26	0.17	40.00
	42.20	2.87	0.30	88.56	0.12	42.00
	40.80	2.78	0.28	88.84	0.11	44.00
	43.80	2.58	0.28	89.13	0.11	46.00
	40.80	1.89	0.19	89.32	0.08	48.00
	41.80	1.94	0.20	89.52	0.08	50.00
	40.10	1.70	0.17	89.69	0.07	52.00
	42.40	1.74	0.18	89.87	0.07	54.00
	42.10	1.35	0.14	90.02	0.06	56.00
	40.60	1.21	0.12	90.14	0.05	58.00
	41.80	1.20	0.13	90.26	0.05	60.00
	45.80	0.99	0.11	90.38	0.05	62.00
	40.80	0.87	0.09	90.47	0.04	64.00
	39.80	0.79	0.08	90.54	0.03	66.00
	41.00	0.14	0.01	90.56	0.01	68.00
	42.30	0.02	0.00	90.56	0.00	70.00
Wash	96.50	0.01	0.00	90.56	0.00	72.00
Carbon	9.95	0.38	9.44	100.00	3.78	
	9.95 (grams)	4.03 (mg/g)	100.00		40.07	

Test No. 24

Conditions: 30 g/L Thiourea & 75 g/L Sulpguric Acid
5% Butanol

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.60	6.10	0.72	0.72	0.25	2.00
	40.50	80.40	9.48	10.20	3.26	4.00
	48.80	94.00	13.36	23.56	4.59	6.00
	42.20	79.00	9.71	33.26	3.33	8.00
	43.80	72.10	9.19	42.46	3.16	10.00
	40.90	71.40	8.50	50.96	2.92	12.00
	41.80	48.50	5.90	56.86	2.03	14.00
	41.10	29.79	3.56	60.43	1.22	16.00
	40.80	29.23	3.47	63.90	1.19	18.00
	40.90	27.74	3.30	67.20	1.13	20.00
	40.10	28.69	3.35	70.55	1.15	22.00
	42.80	27.84	3.47	74.02	1.19	24.00
	44.30	16.69	2.15	76.17	0.74	26.00
	45.20	13.89	1.83	78.00	0.63	28.00
	45.60	11.24	1.49	79.49	0.51	30.00
	42.60	8.20	1.02	80.51	0.35	32.00
	40.80	6.68	0.79	81.30	0.27	34.00
	65.00	6.60	1.25	82.55	0.43	36.00
	41.20	6.88	0.83	83.38	0.28	38.00
	41.80	6.63	0.81	84.18	0.28	40.00
	46.70	6.49	0.88	85.07	0.30	42.00
	59.00	5.99	1.03	86.10	0.35	44.00
	40.70	5.85	0.69	86.79	0.24	46.00
	30.80	4.96	0.44	87.23	0.15	48.00
	40.60	4.57	0.54	87.77	0.19	50.00
	41.30	4.70	0.57	88.34	0.19	52.00
	40.10	5.10	0.60	88.93	0.20	54.00
	40.30	4.83	0.57	89.50	0.19	56.00
	42.00	4.59	0.56	90.06	0.19	58.00
	40.10	4.12	0.48	90.54	0.17	60.00
	43.50	4.12	0.52	91.06	0.18	62.00
	42.10	3.78	0.46	91.53	0.16	64.00
	38.90	3.00	0.34	91.87	0.12	66.00
	40.30	1.59	0.19	92.05	0.06	68.00
Wash	10.38	0.87	0.03	92.08	0.01	70.00
Carbon	9.38	0.29	7.92	100.00	2.72	
	9.38 (grams)	3.66 (mg/g)	100.00		34.35	

Test No. 25

Conditions: 30 g/L Thiourea & 30 g/L Sulphuric Acid
5% Butanol

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.30	7.50	0.84	0.84	0.30	2.00
	40.70	88.00	9.98	10.82	3.58	4.00
	45.30	86.70	10.94	21.76	3.93	6.00
	39.80	83.60	9.27	31.03	3.33	8.00
	40.60	76.30	8.63	39.66	3.10	10.00
	40.30	71.20	7.99	47.65	2.87	12.00
	41.60	43.43	5.03	52.69	1.81	14.00
	42.50	31.79	3.76	56.45	1.35	16.00
	40.90	27.54	3.14	59.59	1.13	18.00
	44.60	27.17	3.38	62.96	1.21	20.00
	44.20	31.06	3.82	66.79	1.37	22.00
	43.60	24.17	2.94	69.72	1.05	24.00
	43.10	16.25	1.95	71.67	0.70	26.00
	42.30	13.67	1.61	73.28	0.58	28.00
	45.30	12.05	1.52	74.81	0.55	30.00
	41.20	9.09	1.04	75.85	0.37	32.00
	42.50	8.13	0.96	76.81	0.35	34.00
	52.10	8.04	1.17	77.98	0.42	36.00
	43.80	7.05	0.86	78.84	0.31	38.00
	43.90	9.09	1.11	79.95	0.40	40.00
	43.70	8.44	1.03	80.98	0.37	42.00
	40.30	8.03	0.90	81.88	0.32	44.00
	40.10	7.00	0.78	82.66	0.28	46.00
	40.30	5.94	0.67	83.33	0.24	48.00
	40.20	5.83	0.65	83.98	0.23	50.00
	42.30	5.91	0.70	84.68	0.25	52.00
	39.80	5.52	0.61	85.29	0.22	54.00
	40.90	5.81	0.66	85.95	0.24	56.00
	40.10	5.65	0.63	86.58	0.23	58.00
	42.60	4.50	0.53	87.12	0.19	60.00
	41.90	3.56	0.42	87.53	0.15	62.00
	45.50	2.89	0.37	87.90	0.13	64.00
	42.90	2.55	0.30	88.20	0.11	66.00
	40.60	2.35	0.27	88.47	0.10	68.00
	40.10	2.10	0.23	88.70	0.08	70.00
Wash	88.70	0.15	0.04	88.74	0.01	72.00
Carbon	9.40	0.43	11.26	100.00	4.04	
	9.40 (grams)	3.82 (mg/g)	100.00		35.90	

Test No. 26

Conditions: 240 g/L Sodium Sulphide (1 M).

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	41.10	758.10	44.48	44.48	31.16	2.00
	40.50	403.60	23.33	67.81	16.35	4.00
	39.80	251.20	14.27	82.09	10.00	6.00
	48.50	76.40	5.29	87.37	3.71	8.00
	40.10	63.90	3.66	91.03	2.56	10.00
	40.80	51.17	2.98	94.01	2.09	12.00
	43.20	22.07	1.36	95.37	0.95	14.00
	41.80	14.43	0.86	96.24	0.60	16.00
	43.60	10.58	0.66	96.89	0.46	18.00
	56.50	7.49	0.60	97.50	0.42	20.00
	41.70	7.24	0.43	97.93	0.30	22.00
	55.00	6.27	0.49	98.42	0.34	24.00
	39.90	4.07	0.23	98.65	0.16	26.00
	43.30	2.18	0.13	98.79	0.09	28.00
	40.80	0.63	0.04	98.82	0.03	30.00
	40.30	0.37	0.02	98.85	0.01	32.00
	41.80	0.23	0.01	98.86	0.01	34.00
	40.60	0.21	0.01	98.87	0.01	36.00
Wash	109.10	0.06	0.01	98.88	0.01	
Carbon	7.69	0.10	1.12	100.00	0.78	
	7.69 (grams)	9.12 (mg/g)	100.00		70.05	

Test No. 27

Conditions: 480 g/L Sodium Sulphide (2 M).

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	41.30	1847.10	60.83	60.83	76.29	2.00
	41.20	619.40	20.35	81.18	25.52	4.00
	75.20	178.10	10.68	91.86	13.39	6.00
	41.30	95.60	3.15	95.01	3.95	8.00
	42.50	63.20	2.14	97.15	2.69	10.00
	45.30	25.92	0.94	98.09	1.17	12.00
	42.90	12.99	0.44	98.53	0.56	14.00
	40.30	10.62	0.34	98.87	0.43	16.00
	46.80	7.23	0.27	99.14	0.34	18.00
	48.50	5.45	0.21	99.35	0.26	20.00
	40.10	5.16	0.16	99.52	0.21	22.00
	47.20	2.15	0.08	99.60	0.10	24.00
	41.30	2.07	0.07	99.67	0.09	26.00
	43.50	1.06	0.04	99.70	0.05	28.00
	41.40	0.72	0.02	99.73	0.03	30.00
	41.70	0.14	0.00	99.73	0.01	32.00
	41.50	0.10	0.00	99.74	0.00	34.00
	40.30	0.09	0.00	99.74	0.00	36.00
Wash	101.40	0.05	0.00	99.74	0.01	
Carbon	8.51	0.04	0.26	100.00	0.32	
	8.51 (grams)	14.73 (mg/g)	100.00		125.41	

Test No. 28

Conditions: 120 g/L Sodium Sulphide (0.5 M).

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	43.10	309.30	21.02	21.02	13.33	2.00
	42.50	565.40	37.88	58.90	24.03	4.00
	42.60	159.50	10.71	69.61	6.79	6.00
	41.80	90.15	5.94	75.56	3.77	8.00
	40.10	72.93	4.61	80.17	2.92	10.00
	40.50	39.30	2.51	82.68	1.59	12.00
	40.30	28.99	1.84	84.52	1.17	14.00
	40.80	26.72	1.72	86.24	1.09	16.00
	41.60	22.37	1.47	87.70	0.93	18.00
	44.60	17.59	1.24	88.94	0.78	20.00
	44.70	14.54	1.02	89.96	0.65	22.00
	40.80	6.85	0.44	90.41	0.28	24.00
	41.60	4.75	0.31	90.72	0.20	26.00
	44.70	3.84	0.27	90.99	0.17	28.00
	43.50	3.64	0.25	91.24	0.16	30.00
	43.90	3.56	0.25	91.48	0.16	32.00
	41.70	3.47	0.23	91.71	0.14	34.00
	41.10	2.81	0.18	91.89	0.12	36.00
	40.60	2.27	0.15	92.04	0.09	38.00
	40.80	1.96	0.13	92.16	0.08	40.00
	42.60	1.71	0.11	92.28	0.07	42.00
	40.10	1.58	0.10	92.38	0.06	44.00
	40.80	1.43	0.09	92.47	0.06	46.00
	40.20	1.35	0.09	92.56	0.05	48.00
	45.00	1.21	0.09	92.64	0.05	50.00
	41.80	1.08	0.07	92.71	0.05	52.00
	40.50	0.97	0.06	92.78	0.04	54.00
	44.20	0.85	0.06	92.84	0.04	56.00
	39.70	0.81	0.05	92.89	0.03	58.00
	38.60	0.76	0.05	92.93	0.03	60.00
	39.30	0.54	0.03	92.97	0.02	62.00
	40.30	0.29	0.02	92.98	0.01	64.00
Wash	71.40	0.03	0.00	92.99	0.00	
Carbon	7.06	0.63	7.01	100.00	4.45	
	7.06 (grams)	8.98 (mg/g)	100.00		63.43	

Test No. 29

Conditions: 120 g/L Sodium Sulphide (0.5 M).
40.5 degree C.

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	Cum.	Metal Unit	B.V. cum.
	43.50	566.10	42.62	42.62	24.63	2.00
	42.30	348.90	25.54	68.16	14.76	4.00
	42.10	145.90	10.63	78.79	6.14	6.00
	41.00	47.20	3.35	82.14	1.94	8.00
	41.20	35.70	2.55	84.68	1.47	10.00
	41.60	19.36	1.39	86.08	0.81	12.00
	40.10	17.22	1.20	87.27	0.69	14.00
	41.80	14.63	1.06	88.33	0.61	16.00
	42.80	9.42	0.70	89.03	0.40	18.00
	43.70	8.31	0.63	89.66	0.36	20.00
	43.90	6.96	0.53	90.19	0.31	22.00
	40.30	5.99	0.42	90.60	0.24	24.00
	40.90	4.74	0.34	90.94	0.19	26.00
	43.10	4.47	0.33	91.27	0.19	28.00
	43.80	3.48	0.26	91.54	0.15	30.00
	42.10	2.98	0.22	91.75	0.13	32.00
	41.10	2.52	0.18	91.93	0.10	34.00
	40.50	2.26	0.16	92.09	0.09	36.00
	42.80	2.08	0.15	92.24	0.09	38.00
	42.50	1.72	0.13	92.37	0.07	40.00
	43.30	1.51	0.11	92.48	0.07	42.00
	43.50	1.46	0.11	92.59	0.06	44.00
	45.80	1.33	0.11	92.70	0.06	46.00
	48.60	1.27	0.11	92.81	0.06	48.00
	41.90	1.21	0.09	92.89	0.05	50.00
	40.10	1.07	0.07	92.97	0.04	52.00
	41.00	0.92	0.07	93.03	0.04	54.00
	42.50	0.87	0.06	93.10	0.04	56.00
	42.80	0.74	0.05	93.15	0.03	58.00
	38.80	0.69	0.05	93.20	0.03	60.00
	41.80	0.41	0.03	93.23	0.02	62.00
	42.10	0.37	0.03	93.26	0.02	64.00
Wash	80.90	0.03	0.00	93.26	0.00	
Carbon	7.49	0.52	6.74	100.00	3.89	
	7.49 (grams)	7.71 (mg/g)	100.00		57.78	

Test No. 30

Conditions: 158.1 g/L Sodium Thiosulphate (anhydrous,
Room temperature

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.30	19.20	1.11	1.11	0.77	2.00
	41.20	40.60	2.39	3.50	1.67	4.00
	50.10	41.74	2.99	6.49	2.09	6.00
	40.00	42.41	2.43	8.92	1.70	8.00
	44.30	49.64	3.15	12.06	2.20	10.00
	43.60	95.21	5.94	18.00	4.15	12.00
	40.30	88.82	5.12	23.12	3.58	14.00
	42.00	84.48	5.08	28.20	3.55	16.00
	45.30	87.92	5.70	33.89	3.98	18.00
	44.10	76.00	4.79	38.69	3.35	20.00
	42.70	75.83	4.63	43.32	3.24	22.00
	40.40	65.14	3.76	47.08	2.63	24.00
	40.30	58.36	3.36	50.45	2.35	26.00
	40.60	49.99	2.90	53.35	2.03	28.00
	40.30	42.41	2.44	55.80	1.71	30.00
	42.10	38.62	2.33	58.12	1.63	32.00
	44.20	36.54	2.31	60.43	1.62	34.00
	40.30	37.90	2.18	62.62	1.53	36.00
	43.80	34.27	2.15	64.76	1.50	38.00
	40.30	33.18	1.91	66.68	1.34	40.00
	41.80	31.20	1.87	68.54	1.30	42.00
	42.30	20.17	1.22	69.76	0.85	44.00
	42.30	12.80	0.77	70.54	0.54	46.00
	40.20	7.90	0.45	70.99	0.32	48.00
	39.80	5.66	0.32	71.31	0.23	50.00
	40.30	1.31	0.08	71.39	0.05	52.00
	40.50	0.87	0.05	71.44	0.04	54.00
Wash	70.90	0.08	0.01	71.45	0.01	
Carbon	7.18	2.78	28.55	100.00	19.96	
	7.18 (grams)	9.74 (mg/g)	100.00		69.91	

Test No. 31

Conditions: 79.05 g/L Sodium Thiosulphate (0.318 M)
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.30	9.60	0.55	0.55	0.39	2.00
	40.00	15.70	0.90	1.45	0.63	4.00
	41.90	22.00	1.32	2.77	0.92	6.00
	40.30	31.70	1.83	4.60	1.28	8.00
	41.80	40.72	2.44	7.04	1.70	10.00
	41.20	38.66	2.28	9.32	1.59	12.00
	41.30	42.32	2.50	11.83	1.75	14.00
	40.80	43.30	2.53	14.36	1.77	16.00
	41.90	51.10	3.07	17.42	2.14	18.00
	40.00	59.20	3.39	20.82	2.37	20.00
	40.10	78.64	4.52	25.33	3.15	22.00
	41.20	65.83	3.88	29.22	2.71	24.00
	40.00	62.51	3.58	32.80	2.50	26.00
	46.40	59.94	3.98	36.78	2.78	28.00
	42.70	64.99	3.97	40.76	2.78	30.00
	42.50	66.47	4.05	44.80	2.82	32.00
	43.80	56.68	3.56	48.36	2.48	34.00
	43.90	56.83	3.57	51.93	2.49	36.00
	41.00	52.49	3.08	55.02	2.15	38.00
	38.90	50.01	2.79	57.80	1.95	40.00
	40.60	48.63	2.83	60.63	1.97	42.00
	41.80	44.76	2.68	63.31	1.87	44.00
	42.50	42.78	2.60	65.91	1.82	46.00
	40.10	38.67	2.22	68.14	1.55	48.00
	40.00	35.83	2.05	70.19	1.43	50.00
	40.10	32.17	1.85	72.04	1.29	52.00
	40.30	30.89	1.78	73.82	1.24	54.00
	42.50	29.95	1.82	75.64	1.27	56.00
	42.10	29.67	1.79	77.43	1.25	58.00
	40.50	27.79	1.61	79.04	1.13	60.00
	43.10	26.04	1.61	80.65	1.12	62.00
	40.00	25.20	1.44	82.09	1.01	64.00
	40.30	24.05	1.39	83.48	0.97	66.00
	38.90	25.01	1.39	84.88	0.97	68.00
	39.90	23.39	1.34	86.21	0.93	70.00
	39.80	22.34	1.27	87.49	0.89	72.00
	40.50	17.35	1.01	88.49	0.70	74.00
	40.10	13.08	0.75	89.24	0.52	76.00
	40.20	10.16	0.59	89.83	0.41	78.00
	40.30	6.99	0.40	90.23	0.28	80.00
	41.20	5.33	0.31	90.55	0.22	82.00
	40.50	3.70	0.21	90.76	0.15	84.00
	40.50	2.42	0.14	90.90	0.10	86.00
Wash	80.50	0.08	0.01	90.91	0.01	
Carbon	7.05	0.90	9.09	100.00	6.35	
	7.05 (grams)	9.90 (mg/g)	100.00		69.82	

Test No. 32

Conditions: 316.2 g/L Sodium Thiosulphate (1.275 M)
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	41.50	77.20	4.83	4.83	3.20	2.00
	45.30	79.30	5.41	10.24	3.59	4.00
	41.20	83.30	5.17	15.41	3.43	6.00
	41.30	85.60	5.32	20.73	3.54	8.00
	40.40	48.65	2.96	23.69	1.97	10.00
	40.50	47.26	2.88	26.57	1.91	12.00
	41.50	46.30	2.89	29.47	1.92	14.00
	42.90	45.99	2.97	32.44	1.97	16.00
	42.70	45.08	2.90	35.34	1.92	18.00
	43.60	44.42	2.92	38.26	1.94	20.00
	41.20	43.41	2.69	40.95	1.79	22.00
	42.60	41.16	2.64	43.59	1.75	24.00
	41.60	40.73	2.55	46.14	1.69	26.00
	46.50	38.06	2.67	48.81	1.77	28.00
	41.40	36.21	2.26	51.07	1.50	30.00
	42.10	35.60	2.26	53.32	1.50	32.00
	43.60	34.46	2.26	55.59	1.50	34.00
	41.80	34.38	2.16	57.75	1.44	36.00
	41.00	33.64	2.08	59.83	1.38	38.00
	39.50	32.49	1.93	61.76	1.28	40.00
	40.80	30.81	1.89	63.66	1.26	42.00
	41.40	29.80	1.86	65.51	1.23	44.00
	39.80	29.11	1.75	67.26	1.16	46.00
	41.70	28.36	1.78	69.04	1.18	48.00
	40.30	27.87	1.69	70.73	1.12	50.00
	41.50	27.66	1.73	72.46	1.15	52.00
	40.10	27.22	1.64	74.10	1.09	54.00
	41.80	26.68	1.68	75.78	1.12	56.00
	40.10	26.18	1.58	77.37	1.05	58.00
	40.80	25.79	1.58	78.95	1.05	60.00
	40.30	24.17	1.47	80.42	0.97	62.00
	40.00	23.42	1.41	81.83	0.94	64.00
	40.10	22.94	1.39	83.21	0.92	66.00
	39.80	22.72	1.36	84.58	0.90	68.00
	44.50	22.56	1.51	86.09	1.00	70.00
	39.90	20.75	1.25	87.34	0.83	72.00
	41.80	20.38	1.28	88.62	0.85	74.00
	40.90	18.20	1.12	89.74	0.74	76.00
	39.80	14.65	0.88	90.62	0.58	78.00
	39.60	12.43	0.74	91.36	0.49	80.00
	40.30	8.44	0.51	91.87	0.34	82.00
	39.50	3.17	0.19	92.06	0.13	84.00
Wash	86.30	0.18	0.02	92.08	0.02	
Carbon	7.20	0.73	7.92	100.00	5.26	
	7.20	9.22	100.00		66.39	
	(grams)	(mg/g)				

Test No. 33

Conditions: 30% Acetonitrile, 50 g/L Thiourea, 50g/L H
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	41.30	119.90	12.68	12.68	4.95	2.00
	40.20	155.70	16.03	28.71	6.26	4.00
	40.80	116.80	12.20	40.91	4.77	6.00
	40.10	120.30	12.35	53.27	4.82	8.00
	40.00	87.10	8.92	62.19	3.48	10.00
	40.30	51.70	5.34	67.53	2.08	12.00
	40.20	31.15	3.21	70.73	1.25	14.00
	40.30	20.41	2.11	72.84	0.82	16.00
	42.90	16.80	1.85	74.69	0.72	18.00
	45.70	13.24	1.55	76.23	0.61	20.00
	42.30	11.14	1.21	77.44	0.47	22.00
	42.50	10.69	1.16	78.61	0.45	24.00
	41.20	9.02	0.95	79.56	0.37	26.00
	45.40	7.46	0.87	80.42	0.34	28.00
	40.70	6.98	0.73	81.15	0.28	30.00
	41.80	6.33	0.68	81.83	0.26	32.00
	44.80	6.14	0.70	82.53	0.28	34.00
	47.20	6.03	0.73	83.26	0.28	36.00
	40.50	5.82	0.60	83.87	0.24	38.00
	38.20	5.22	0.51	84.38	0.20	40.00
	40.10	5.19	0.53	84.91	0.21	42.00
	40.20	5.07	0.52	85.43	0.20	44.00
	40.50	5.01	0.52	85.95	0.20	46.00
	40.60	4.94	0.51	86.47	0.20	48.00
	40.10	4.81	0.49	86.96	0.19	50.00
	40.70	4.65	0.48	87.44	0.19	52.00
	40.20	5.02	0.52	87.96	0.20	54.00
	39.30	4.29	0.43	88.39	0.17	56.00
	41.20	3.74	0.39	88.79	0.15	58.00
	40.80	3.11	0.32	89.11	0.13	60.00
	41.00	2.92	0.31	89.42	0.12	62.00
	41.50	2.68	0.28	89.70	0.11	64.00
	40.20	2.38	0.25	89.95	0.10	66.00
	39.50	2.27	0.23	90.18	0.09	68.00
	40.80	2.15	0.22	90.40	0.09	70.00
	39.70	2.07	0.21	90.61	0.08	72.00
	43.80	2.02	0.23	90.84	0.09	74.00
	41.90	1.02	0.11	90.95	0.04	76.00
	40.10	0.83	0.09	91.03	0.03	78.00
	40.40	0.67	0.07	91.10	0.03	80.00
	40.00	0.41	0.04	91.15	0.02	82.00
	41.50	0.25	0.03	91.17	0.01	84.00
	41.20	0.12	0.01	91.18	0.00	86.00
Wash	83.80	0.03	0.01	91.19	0.00	
Carbon	6.49	0.53	8.81	100.00	3.44	
	6.49 (grams)	6.02 (mg/g)	100.00		39.05	

Test No. 34

Conditions: 60.05 g/L Sodium Sulphide (0.25 M)
Room temperture

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution		Metal Unit	B.V. cum.
			Ind.	Cum.		
	40.20	82.10	7.70	7.70	3.30	2.00
	40.30	102.20	9.61	17.30	4.12	4.00
	40.40	86.40	8.14	25.45	3.49	6.00
	41.50	78.50	7.60	33.05	3.26	8.00
	41.20	69.99	6.73	39.77	2.88	10.00
	44.50	57.43	5.96	45.73	2.56	12.00
	41.20	50.04	4.81	50.54	2.06	14.00
	40.30	43.54	4.09	54.63	1.75	16.00
	40.60	27.03	2.56	57.19	1.10	18.00
	40.20	14.47	1.36	58.55	0.58	20.00
	40.30	13.75	1.29	59.84	0.55	22.00
	40.30	12.82	1.21	61.05	0.52	24.00
	42.10	10.13	0.99	62.04	0.43	26.00
	39.80	8.91	0.83	62.87	0.35	28.00
	40.20	7.88	0.74	63.61	0.32	30.00
	39.60	6.43	0.59	64.20	0.25	32.00
	40.30	5.33	0.50	64.70	0.21	34.00
	40.30	5.64	0.53	65.23	0.23	36.00
	40.80	5.48	0.52	65.75	0.22	38.00
	40.70	4.78	0.45	66.21	0.19	40.00
	40.30	4.45	0.42	66.63	0.18	42.00
	39.50	3.32	0.31	66.93	0.13	44.00
	38.50	1.59	0.14	67.08	0.06	46.00
	44.90	0.95	0.10	67.18	0.04	48.00
	41.80	0.34	0.03	67.21	0.01	50.00
Wash	81.20	0.01	0.00	67.21	0.00	
Carbon	8.52	1.65	32.79	100.00	14.06	
	8.52	5.03	100.00		42.87	
	(grams)	(mg/g)				

Test No. 35

Conditions: 60.05 g/L Sodium Sulphide (0.25 M)
40 degree C.

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.50	24.70	1.91	1.91	1.00	2.00
	40.80	283.10	22.02	23.93	11.55	4.00
	41.80	149.30	11.90	35.83	6.24	6.00
	40.70	95.50	7.41	43.24	3.89	8.00
	40.00	63.50	4.84	48.09	2.54	10.00
	42.10	54.43	4.37	52.45	2.29	12.00
	40.30	66.54	5.11	57.57	2.68	14.00
	40.10	124.90	9.55	67.12	5.01	16.00
	40.30	88.70	6.82	73.93	3.57	18.00
	39.80	63.94	4.85	78.79	2.54	20.00
	39.50	57.34	4.32	83.10	2.26	22.00
	39.90	45.31	3.45	86.55	1.81	24.00
	40.20	10.70	0.82	87.37	0.43	26.00
	40.30	7.80	0.60	87.97	0.31	28.00
	40.80	6.85	0.53	88.50	0.28	30.00
	41.90	5.95	0.48	88.98	0.25	32.00
	41.50	5.38	0.43	89.41	0.22	34.00
	39.90	4.99	0.38	89.78	0.20	36.00
	39.70	2.56	0.19	89.98	0.10	38.00
	40.80	1.58	0.12	90.10	0.06	40.00
	41.40	1.38	0.11	90.21	0.06	42.00
	40.80	1.34	0.10	90.31	0.05	44.00
	39.50	1.06	0.08	90.39	0.04	46.00
	42.50	0.66	0.05	90.45	0.03	48.00
	39.30	0.21	0.02	90.46	0.01	50.00
Wash	80.50	0.05	0.01	90.47	0.00	
Carbon	8.47	0.59	9.53	100.00	5.00	
	8.47 (grams)	6.19 (mg/g)	100.00		52.45	

Test No. 36

Conditions: 50 g/L Thiourea & 50 g/L Sulphuric Acid
5% Diethyl Ether
Two bed volume per hour

Volume	Assay	% Distribution		Metal	B.V.
ml	Au, mg/L	Ind.	Cum.	Unit	cum.
42.40	0.52	0.04	0.04	0.02	2.00
40.40	2.86	0.22	0.26	0.12	4.00
40.60	8.58	0.67	0.93	0.35	6.00
41.30	21.67	1.71	2.64	0.89	8.00
39.80	31.05	2.36	5.00	1.24	10.00
41.30	37.59	2.96	7.96	1.55	12.00
41.50	39.41	3.12	11.08	1.64	14.00
41.70	39.71	3.16	14.25	1.66	16.00
39.80	48.23	3.67	17.91	1.92	18.00
39.60	51.50	3.89	21.81	2.04	20.00
42.50	48.06	3.90	25.71	2.04	22.00
39.80	44.47	3.38	29.09	1.77	24.00
39.90	39.56	3.01	32.10	1.58	26.00
43.30	33.96	2.81	34.91	1.47	28.00
39.50	29.96	2.26	37.17	1.18	30.00
40.40	24.98	1.93	39.10	1.01	32.00
39.90	23.67	1.80	40.90	0.94	34.00
39.80	23.02	1.75	42.65	0.92	36.00
40.10	23.15	1.77	44.42	0.93	38.00
40.30	22.02	1.69	46.12	0.89	40.00
39.40	21.56	1.62	47.74	0.85	42.00
39.90	21.10	1.61	49.35	0.84	44.00
39.50	19.03	1.44	50.78	0.75	46.00
40.10	17.97	1.38	52.16	0.72	48.00
39.40	15.19	1.14	53.30	0.60	50.00
39.70	14.80	1.12	54.42	0.59	52.00
39.80	14.34	1.09	55.51	0.57	54.00
39.90	13.35	1.02	56.53	0.53	56.00
39.50	12.53	0.95	57.47	0.49	58.00
40.10	11.90	0.91	58.39	0.48	60.00
42.50	11.14	0.90	59.29	0.47	62.00
41.50	10.89	0.86	60.15	0.45	64.00
41.30	10.37	0.82	60.97	0.43	66.00
40.30	9.79	0.75	61.72	0.39	68.00
40.60	10.83	0.84	62.56	0.44	70.00
40.70	10.58	0.82	63.39	0.43	72.00
41.50	9.48	0.75	64.14	0.39	74.00
40.90	8.94	0.70	64.83	0.37	76.00
40.30	4.25	0.33	65.16	0.17	78.00
41.20	2.10	0.17	65.33	0.09	80.00
42.50	1.05	0.09	65.41	0.04	82.00
40.30	0.91	0.07	65.48	0.04	84.00
39.60	0.76	0.06	65.54	0.03	86.00
40.50	0.69	0.05	65.59	0.03	88.00
40.60	0.58	0.04	65.64	0.02	90.00

	39.90	0.53	0.04	65.68	0.02	92.00
	40.80	0.47	0.04	65.72	0.02	94.00
	41.20	0.36	0.03	65.74	0.01	96.00
	40.90	0.29	0.02	65.77	0.01	98.00
	39.70	0.17	0.01	65.78	0.01	100.00
Wash	80.50	0.01	0.00	65.78	0.00	
Carbon	8.96	2.00	34.22	100.00	17.92	
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	8.96	5.84	100.00		52.37	
	(grams)	(mg/g)				

Test No. 37

Conditions: 50 g/L Thiourea & 50 g/L Sulphuric Acid
5% Diethyl Ether At 40 degree C.
Two bed volume per hour

Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
40.20	0.19	0.02	0.02	0.01	2.00
40.30	0.80	0.07	0.09	0.03	4.00
40.50	1.55	0.14	0.23	0.06	6.00
41.40	5.75	0.53	0.76	0.24	8.00
41.50	10.47	0.97	1.73	0.43	10.00
40.90	17.00	1.56	3.29	0.70	12.00
39.90	48.09	4.29	7.58	1.92	14.00
41.90	72.62	6.81	14.39	3.04	16.00
42.60	90.70	8.65	23.04	3.86	18.00
40.40	79.36	7.17	30.21	3.21	20.00
41.00	64.68	5.93	36.14	2.65	22.00
41.50	51.73	4.80	40.95	2.15	24.00
40.50	39.91	3.62	44.56	1.62	26.00
46.50	39.31	4.09	48.65	1.83	28.00
41.10	27.38	2.52	51.17	1.13	30.00
40.50	23.27	2.11	53.28	0.94	32.00
40.90	22.68	2.08	55.36	0.93	34.00
39.90	19.63	1.75	57.11	0.78	36.00
40.30	19.16	1.73	58.84	0.77	38.00
40.60	20.85	1.89	60.73	0.85	40.00
42.30	19.96	1.89	62.62	0.84	42.00
40.70	18.19	1.66	64.28	0.74	44.00
40.50	17.85	1.62	65.89	0.72	46.00
41.50	15.57	1.45	67.34	0.65	48.00
41.80	15.02	1.40	68.74	0.63	50.00
41.40	14.49	1.34	70.09	0.60	52.00
39.40	14.19	1.25	71.34	0.56	54.00
40.70	13.68	1.25	72.58	0.56	56.00
40.20	12.39	1.11	73.70	0.50	58.00
40.30	10.18	0.92	74.62	0.41	60.00
41.40	9.69	0.90	75.51	0.40	62.00
40.10	9.08	0.81	76.33	0.36	64.00
39.80	8.20	0.73	77.06	0.33	66.00
40.20	7.42	0.67	77.73	0.30	68.00
39.80	7.49	0.67	78.39	0.30	70.00
41.00	7.25	0.67	79.06	0.30	72.00
40.30	6.98	0.63	79.69	0.28	74.00
41.50	6.40	0.59	80.28	0.27	76.00
41.00	5.16	0.47	80.75	0.21	78.00
40.80	4.97	0.45	81.21	0.20	80.00
40.20	4.02	0.36	81.57	0.16	82.00
40.80	2.75	0.25	81.82	0.11	84.00
40.30	2.46	0.22	82.04	0.10	86.00
40.10	2.39	0.21	82.26	0.10	88.00
41.20	2.03	0.19	82.44	0.08	90.00

	40.80	1.64	0.15	82.59	0.07	92.00
	40.30	1.21	0.11	82.70	0.05	94.00
	40.90	0.92	0.08	82.79	0.04	96.00
	41.10	0.66	0.06	82.85	0.03	98.00
	40.10	0.31	0.03	82.88	0.01	100.00
Wash	84.20	0.07	0.01	82.89	0.01	
Carbon	8.69	0.88	17.11	100.00	7.65	
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	8.69	5.14	100.00		44.69	
	(grams)	(mg/g)				

Test No. 38

Conditions: 50 g/L Thiourea & 50 g/L Sulphuric Acid
10% Diethyl Ether
Two bed volume per hour

Volume	Assay	% Distribution		Metal	B.V.
ml	Au, mg/L	Ind.	Cum.	Unit	cum.
39.70	0.55	0.05	0.05	0.02	2.00
41.80	8.23	0.74	0.79	0.34	4.00
39.50	55.23	4.69	5.48	2.18	6.00
39.80	79.82	6.83	12.30	3.18	8.00
41.10	92.76	8.19	20.50	3.81	10.00
41.30	101.34	9.00	29.49	4.19	12.00
39.60	89.98	7.66	37.15	3.56	14.00
40.10	73.42	6.33	43.48	2.94	16.00
40.30	51.83	4.49	47.97	2.09	18.00
40.90	42.39	3.73	51.69	1.73	20.00
41.50	32.90	2.93	54.63	1.37	22.00
40.80	30.85	2.71	57.33	1.26	24.00
40.90	28.04	2.46	59.80	1.15	26.00
42.40	23.81	2.17	61.97	1.01	28.00
39.80	22.64	1.94	63.90	0.90	30.00
40.40	21.54	1.87	65.78	0.87	32.00
40.20	17.91	1.55	67.32	0.72	34.00
40.30	15.31	1.33	68.65	0.62	36.00
42.50	13.40	1.22	69.87	0.57	38.00
41.70	12.18	1.09	70.96	0.51	40.00
44.50	11.51	1.10	72.07	0.51	42.00
39.50	10.84	0.92	72.99	0.43	44.00
39.50	11.01	0.93	73.92	0.43	46.00
40.80	10.71	0.94	74.86	0.44	48.00
39.70	10.03	0.86	75.71	0.40	50.00
41.20	9.59	0.85	76.56	0.40	52.00
40.50	7.66	0.67	77.23	0.31	54.00
40.00	7.16	0.62	77.85	0.29	56.00
40.80	6.57	0.58	78.42	0.27	58.00
40.20	6.39	0.55	78.97	0.26	60.00
40.00	5.88	0.51	79.48	0.24	62.00
39.80	5.59	0.48	79.96	0.22	64.00
40.50	5.29	0.46	80.42	0.21	66.00
41.20	5.20	0.46	80.88	0.21	68.00
39.80	4.01	0.34	81.22	0.16	70.00
40.90	3.61	0.32	81.54	0.15	72.00
40.30	2.93	0.25	81.79	0.12	74.00
41.10	2.81	0.25	82.04	0.12	76.00
41.80	2.67	0.24	82.28	0.11	78.00
40.50	2.30	0.20	82.48	0.09	80.00
41.80	2.29	0.21	82.69	0.10	82.00
40.20	2.01	0.17	82.86	0.08	84.00
40.80	1.80	0.16	83.02	0.07	86.00
40.90	1.36	0.12	83.14	0.06	88.00
41.20	1.03	0.09	83.23	0.04	90.00

	40.30	0.87	0.08	83.31	0.04	92.00
	40.90	0.52	0.05	83.35	0.02	94.00
	40.00	0.23	0.02	83.37	0.01	96.00
Wash	85.60	0.05	0.01	83.38	0.00	
Carbon	8.14	0.95	16.62	100.00	7.73	
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	8.14 (grams)	5.72 (mg/g)	100.00		46.53	

Test No. 39

Conditions: 50 g/L Thiourea & 50 g/L Sulphuric Acid
10% Diehtyl Ether At 40 degree C.
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	39.30	0.18	0.02	0.02	0.01	2.00
	41.20	8.73	0.78	0.79	0.36	4.00
	40.30	16.40	1.43	2.22	0.66	6.00
	39.80	134.40	11.57	13.80	5.35	8.00
	40.30	245.60	21.41	35.21	9.90	10.00
	40.20	175.30	15.25	50.46	7.05	12.00
	39.80	95.90	8.26	58.71	3.82	14.00
	40.10	55.30	4.80	63.51	2.22	16.00
	39.90	43.96	3.79	67.31	1.75	18.00
	40.70	43.11	3.80	71.10	1.75	20.00
	39.30	28.75	2.44	73.55	1.13	22.00
	39.50	24.08	2.06	75.61	0.95	24.00
	39.80	19.68	1.69	77.30	0.78	26.00
	41.50	15.51	1.39	78.69	0.64	28.00
	40.60	10.50	0.92	79.62	0.43	30.00
	39.80	10.00	0.86	80.48	0.40	32.00
	40.30	10.14	0.88	81.36	0.41	34.00
	40.00	10.57	0.91	82.28	0.42	36.00
	40.20	9.01	0.78	83.06	0.36	38.00
	41.00	8.68	0.77	83.83	0.36	40.00
	39.50	7.71	0.66	84.49	0.30	42.00
	39.50	5.99	0.51	85.00	0.24	44.00
	40.80	2.44	0.22	85.22	0.10	46.00
	40.90	1.06	0.09	85.31	0.04	48.00
	40.30	0.81	0.07	85.38	0.03	50.00
	40.20	0.43	0.04	85.42	0.02	52.00
	40.50	0.36	0.03	85.45	0.01	54.00
	40.30	0.21	0.02	85.47	0.01	56.00
Wash	81.60	0.07	0.01	85.48	0.01	
Carbon	7.99	0.84	14.52	100.00	6.71	
	7.99	5.78	100.00		46.22	
	(grams)	(mg/g)				

Test No. 40

Conditions: 50 g/L Thiourea & 50 g/L Sulphuric Acid
15% Diethyl Ether
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.30	0.99	0.09	0.09	0.04	2.00
	41.40	4.38	0.41	0.51	0.18	4.00
	40.80	8.73	0.81	1.32	0.36	6.00
	39.90	17.06	1.55	2.87	0.68	8.00
	40.80	22.17	2.06	4.94	0.90	10.00
	41.80	27.55	2.63	7.57	1.15	12.00
	39.50	34.37	3.10	10.67	1.36	14.00
	40.50	37.54	3.47	14.14	1.52	16.00
	40.50	35.73	3.30	17.44	1.45	18.00
	40.80	33.47	3.12	20.56	1.37	20.00
	43.10	31.30	3.08	23.64	1.35	22.00
	40.10	29.42	2.69	26.33	1.18	24.00
	42.30	28.85	2.79	29.12	1.22	26.00
	41.00	27.27	2.55	31.67	1.12	28.00
	40.80	23.70	2.21	33.88	0.97	30.00
	41.30	21.48	2.03	35.90	0.89	32.00
	40.90	21.31	1.99	37.89	0.87	34.00
	45.50	21.06	2.19	40.08	0.96	36.00
	39.80	20.99	1.91	41.98	0.84	38.00
	41.30	20.03	1.89	43.87	0.83	40.00
	39.80	20.15	1.83	45.70	0.80	42.00
	39.90	19.12	1.74	47.45	0.76	44.00
	39.50	10.12	0.91	48.36	0.40	46.00
	39.50	6.22	0.56	48.92	0.25	48.00
	40.50	3.24	0.30	49.22	0.13	50.00
	42.80	1.93	0.19	49.41	0.08	52.00
	41.20	0.83	0.08	49.48	0.03	54.00
	39.80	0.31	0.03	49.51	0.01	56.00
Wash	83.50	0.05	0.01	49.52	0.00	
Carbon	8.22	2.69	50.48	100.00	22.11	
	8.22 (grams)	5.33 (mg/g)	100.00		43.81	

Test No. 41

Conditions: 50 g/L thiourea & 50 g/L Sulphuric acid
20% Diethyl Ether
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.60	6.23	0.54	0.54	0.25	2.00
	39.80	30.01	2.55	3.09	1.19	4.00
	40.50	46.18	4.00	7.09	1.87	6.00
	41.50	51.32	4.55	11.64	2.13	8.00
	41.20	56.96	5.01	16.65	2.35	10.00
	45.80	51.67	5.06	21.71	2.37	12.00
	42.10	46.74	4.20	25.91	1.97	14.00
	40.30	40.70	3.50	29.42	1.64	16.00
	40.10	38.50	3.30	32.72	1.54	18.00
	43.10	37.49	3.45	36.17	1.62	20.00
	41.30	33.70	2.97	39.14	1.39	22.00
	41.50	32.58	2.89	42.03	1.35	24.00
	41.00	30.94	2.71	44.74	1.27	26.00
	40.30	29.82	2.57	47.31	1.20	28.00
	41.20	26.92	2.37	49.68	1.11	30.00
	40.90	24.24	2.12	51.80	0.99	32.00
	40.30	19.23	1.66	53.45	0.77	34.00
	40.50	17.96	1.55	55.01	0.73	36.00
	41.10	7.88	0.69	55.70	0.32	38.00
	40.80	3.04	0.26	55.96	0.12	40.00
Wash	84.60	0.09	0.02	55.98	0.01	
Carbon	8.41	2.45	44.02	100.00	20.60	
	8.41 (grams)	5.57 (mg/g)	100.00		46.81	

Test No. 42

Conditions: 30 g/L Sodium Sulphide (0.125 M)

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution		Metal Unit	B.V. cum.
			Ind.	Cum.		
	40.30	0.18	0.02	0.02	0.01	2.00
	40.60	40.24	3.63	3.64	1.63	4.00
	39.40	47.45	4.15	7.79	1.87	6.00
	39.90	42.75	3.78	11.57	1.71	8.00
	42.50	24.23	2.28	13.86	1.03	10.00
	40.50	18.74	1.68	15.54	0.76	12.00
	40.10	14.84	1.32	16.86	0.60	14.00
	43.20	14.62	1.40	18.27	0.63	16.00
	42.50	11.70	1.10	19.37	0.50	18.00
	40.90	7.96	0.72	20.09	0.33	20.00
	41.20	6.93	0.63	20.72	0.29	22.00
	39.90	6.15	0.54	21.27	0.25	24.00
	39.50	5.40	0.47	21.74	0.21	26.00
	40.80	4.89	0.44	22.18	0.20	28.00
	39.40	4.63	0.40	22.59	0.18	30.00
	39.80	4.01	0.35	22.94	0.16	32.00
	40.10	4.73	0.42	23.36	0.19	34.00
	41.50	4.70	0.43	23.80	0.20	36.00
	39.50	4.21	0.37	24.17	0.17	38.00
	40.70	3.09	0.28	24.45	0.13	40.00
	39.80	1.05	0.09	24.54	0.04	42.00
	39.90	0.69	0.06	24.60	0.03	44.00
	39.80	0.31	0.03	24.63	0.01	46.00
Wash	81.30	0.06	0.01	24.64	0.00	
Carbon	7.79	4.36	75.36	100.00	33.96	
	7.79 (grams)	5.79 (mg/g)	100.00		45.07	

Test No. 43

Conditions: 30 g/L Sodium Sulphide (0.125 M)
80 degree C
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	4.73	0.56	0.56	0.19	2.00
	41.70	166.30	20.43	20.99	6.93	4.00
	39.50	161.30	18.77	39.77	6.37	6.00
	41.90	85.60	10.57	50.33	3.59	8.00
	40.80	47.41	5.70	56.03	1.93	10.00
	48.50	34.06	4.87	60.90	1.65	12.00
	42.40	16.89	2.11	63.01	0.72	14.00
	43.30	14.83	1.89	64.90	0.64	16.00
	40.80	11.97	1.44	66.34	0.49	18.00
	40.40	11.74	1.40	67.74	0.47	20.00
	43.50	11.38	1.46	69.20	0.50	22.00
	42.80	11.13	1.40	70.60	0.48	24.00
	41.20	10.61	1.29	71.89	0.44	26.00
	42.50	6.02	0.75	72.65	0.26	28.00
	39.80	5.35	0.63	73.27	0.21	30.00
	39.60	4.21	0.49	73.76	0.17	32.00
	41.20	3.24	0.39	74.16	0.13	34.00
	39.30	2.73	0.32	74.47	0.11	36.00
	39.80	2.22	0.26	74.73	0.09	38.00
	40.30	1.89	0.22	74.96	0.08	40.00
	38.70	1.13	0.13	75.09	0.04	42.00
	39.70	0.88	0.10	75.19	0.03	44.00
	39.50	0.67	0.08	75.27	0.03	46.00
Wash	80.80	0.02	0.00	75.27	0.00	
Carbon	7.56	1.11	24.73	100.00	8.39	
	7.56 (grams)	4.49 (mg/g)	100.00		33.94	

Test No. 44

Conditions: 50 g/L Thioure & 100 g/L Sulphuric Acid
10% Acetonitrile

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.50	0.35	0.04	0.04	0.01	2.00
	41.80	2.33	0.24	0.28	0.10	4.00
	41.30	3.04	0.31	0.59	0.13	6.00
	40.30	3.29	0.33	0.91	0.13	8.00
	43.20	3.44	0.37	1.28	0.15	10.00
	42.80	3.49	0.37	1.65	0.15	12.00
	41.00	3.52	0.36	2.01	0.14	14.00
	42.30	3.55	0.37	2.38	0.15	16.00
	41.30	3.25	0.33	2.71	0.13	18.00
	42.60	3.19	0.34	3.04	0.14	20.00
	41.60	3.24	0.33	3.38	0.13	22.00
	39.50	3.21	0.31	3.69	0.13	24.00
	42.50	3.24	0.34	4.03	0.14	26.00
	39.50	3.03	0.30	4.32	0.12	28.00
	39.30	2.99	0.29	4.61	0.12	30.00
	40.50	2.10	0.21	4.82	0.09	32.00
	39.50	1.99	0.19	5.02	0.08	34.00
	40.10	1.01	0.10	5.12	0.04	36.00
	39.60	0.56	0.05	5.17	0.02	38.00
Wash	80.50	0.07	0.01	5.19	0.01	
Carbon	8.57	4.48	94.81	100.00	38.39	
	8.57 (grams)	4.73 (mg/g)	100.00		40.49	

Test No. 45

Conditions: 50 g/L Thiourea & 100 g/L Sulphuric Acid
5% Butonal

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	39.80	0.22	0.03	0.03	0.01	2.00
	39.60	57.20	7.00	7.03	2.27	4.00
	42.50	72.40	9.51	16.54	3.08	6.00
	40.10	102.70	12.73	29.26	4.12	8.00
	37.50	82.50	9.56	38.82	3.09	10.00
	40.50	63.19	7.91	46.73	2.56	12.00
	40.90	39.13	4.95	51.68	1.60	14.00
	40.30	39.15	4.88	56.55	1.58	16.00
	41.40	36.95	4.73	61.28	1.53	18.00
	40.10	34.21	4.24	65.52	1.37	20.00
	45.30	27.40	3.84	69.35	1.24	22.00
	38.90	24.43	2.94	72.29	0.95	24.00
	40.10	23.95	2.97	75.26	0.96	26.00
	41.30	22.09	2.82	78.08	0.91	28.00
	40.50	13.51	1.69	79.77	0.55	30.00
	40.30	10.80	1.34	81.11	0.44	32.00
	39.80	9.97	1.23	82.34	0.40	34.00
	40.20	8.88	1.10	83.44	0.36	36.00
	40.50	8.38	1.05	84.49	0.34	38.00
	40.30	6.49	0.81	85.30	0.26	40.00
	39.80	5.03	0.62	85.92	0.20	42.00
	39.30	3.97	0.48	86.40	0.16	44.00
	36.50	1.02	0.12	86.52	0.04	46.00
	41.30	0.87	0.11	86.63	0.04	48.00
	40.10	0.54	0.07	86.69	0.02	50.00
	40.30	0.11	0.01	86.71	0.00	52.00
Wash	89.10	0.05	0.01	86.72	0.00	
Carbon	8.77	0.49	13.28	100.00	4.30	
	8.77 (grams)	3.69 (mg/g)	100.00		32.36	

Test No. 46

Conditions: 50 g/L Thiourea & 100 g/L Sulphuric Acid
5% Butonal At 40 degree C.

Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	42.40	7.77	1.11	1.11	0.33	2.00
	41.30	100.90	14.07	15.18	4.17	4.00
	42.70	145.60	20.99	36.18	6.22	6.00
	39.50	109.20	14.56	50.74	4.31	8.00
	38.00	76.42	9.81	60.55	2.90	10.00
	40.10	57.74	7.82	68.37	2.32	12.00
	40.40	35.72	4.87	73.24	1.44	14.00
	40.60	32.66	4.48	77.72	1.33	16.00
	41.30	18.37	2.56	80.28	0.76	18.00
	42.90	16.61	2.41	82.68	0.71	20.00
	44.50	15.82	2.38	85.06	0.70	22.00
	39.30	14.41	1.91	86.97	0.57	24.00
	40.30	12.72	1.73	88.70	0.51	26.00
	40.50	10.23	1.40	90.10	0.41	28.00
	39.50	8.40	1.12	91.22	0.33	30.00
	42.50	6.62	0.95	92.17	0.28	32.00
	40.80	5.56	0.77	92.94	0.23	34.00
	40.50	2.55	0.35	93.29	0.10	36.00
	39.50	2.38	0.32	93.61	0.09	38.00
	42.50	2.02	0.29	93.90	0.09	40.00
	40.80	1.73	0.24	94.13	0.07	42.00
	39.80	1.43	0.19	94.33	0.06	44.00
	41.20	1.09	0.15	94.48	0.04	46.00
	42.90	0.74	0.11	94.59	0.03	48.00
	40.90	0.21	0.03	94.61	0.01	50.00
	41.10	0.17	0.02	94.64	0.01	52.00
Wash	82.30	0.03	0.01	94.65	0.00	
Carbon	7.55	0.21	5.35	100.00	1.59	
	7.55 (grams)	3.92 (mg/g)	100.00		29.61	

Test No. 47

Conditions: 35 g/L Thiourea & 35 g/L Sulphuric Acid
40% Acetone

Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	42.30	30.09	3.39	3.39	1.27	2.00
	39.80	104.10	11.03	14.42	4.14	4.00
	38.00	86.99	8.80	23.22	3.31	6.00
	40.60	81.80	8.84	32.06	3.32	8.00
	40.50	72.14	7.78	39.84	2.92	10.00
	40.80	66.20	7.19	47.03	2.70	12.00
	43.60	56.73	6.58	53.61	2.47	14.00
	41.90	46.13	5.15	58.76	1.93	16.00
	39.80	40.20	4.26	63.02	1.60	18.00
	39.50	29.50	3.10	66.12	1.17	20.00
	40.50	28.46	3.07	69.19	1.15	22.00
	39.50	24.79	2.61	71.79	0.98	24.00
	40.80	22.99	2.50	74.29	0.94	26.00
	41.30	18.72	2.06	76.35	0.77	28.00
	44.50	10.60	1.26	77.61	0.47	30.00
	41.30	10.01	1.10	78.71	0.41	32.00
	40.80	7.63	0.83	79.53	0.31	34.00
	41.30	6.97	0.77	80.30	0.29	36.00
	44.50	5.82	0.69	80.99	0.26	38.00
	39.70	4.73	0.50	81.49	0.19	40.00
	39.50	2.98	0.31	81.80	0.12	42.00
	40.10	2.01	0.21	82.02	0.08	44.00
	39.30	1.25	0.13	82.15	0.05	46.00
	39.50	0.22	0.02	82.17	0.01	48.00
Wash	86.50	0.07	0.02	82.19	0.01	
Carbon	8.26	0.81	17.81	100.00	6.69	
	8.26 (grams)	4.55 (mg/g)	100.00		37.56	

Test No. 48

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
40% acetone
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	32.50	68.10	5.79	5.79	2.21	2.00
	45.00	70.80	8.34	14.14	3.19	4.00
	59.10	76.20	11.79	25.93	4.50	6.00
	40.30	72.10	7.61	33.53	2.91	8.00
	43.00	63.70	7.17	40.70	2.74	10.00
	40.00	48.84	5.11	45.82	1.95	12.00
	40.00	40.45	4.24	50.05	1.62	14.00
	23.30	33.70	2.06	52.11	0.79	16.00
	50.00	26.96	3.53	55.64	1.35	18.00
	56.30	37.19	5.48	61.12	2.09	20.00
	57.30	24.41	3.66	64.78	1.40	22.00
	55.30	17.59	2.55	67.33	0.97	24.00
	40.00	14.36	1.50	68.83	0.57	26.00
	40.10	16.90	1.77	70.61	0.68	28.00
	48.00	15.08	1.90	72.50	0.72	30.00
	31.00	12.69	1.03	73.53	0.39	32.00
Wash	91.00	3.36	0.80	74.33	0.31	
Carbon	8.17	1.20	25.67	100.00	9.80	
	8.17 (grams)	4.68 (mg/g)	100.00		38.20	

Test No. 49

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
50% acetone
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	45.00	106.00	11.77	11.77	4.77	2.00
	37.20	226.80	20.82	32.58	8.44	4.00
	63.00	109.20	16.97	49.56	6.88	6.00
	32.50	54.70	4.39	53.94	1.78	8.00
	40.00	51.30	5.06	59.01	2.05	10.00
	40.00	39.80	3.93	62.94	1.59	12.00
	21.50	30.60	1.62	64.56	0.66	14.00
	32.50	49.39	3.96	68.52	1.61	16.00
	28.90	44.74	3.19	71.71	1.29	18.00
	32.80	44.00	3.56	75.27	1.44	20.00
	47.00	24.61	2.85	78.12	1.16	22.00
	40.00	12.34	1.22	79.34	0.49	24.00
	45.00	9.55	1.06	80.40	0.43	26.00
	41.20	7.91	0.80	81.21	0.33	28.00
	40.00	13.13	1.30	82.50	0.53	30.00
	44.30	8.04	0.88	83.38	0.36	32.00
	55.10	5.59	0.76	84.14	0.31	34.00
Wash	90.00	2.43	0.54	84.68	0.22	
Carbon	7.86	0.79	15.32	100.00	6.21	
	7.86 (grams)	5.16 (mg/g)	100.00		40.53	

Test No. 50

Conditions: 2 g/L NaOH
50% acetone
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	32.60	87.50	5.91	5.91	2.85	2.00
	38.40	70.50	5.61	11.51	2.71	4.00
	52.30	24.12	2.61	14.12	1.26	6.00
	65.50	14.90	2.02	16.14	0.98	8.00
	40.00	26.19	2.17	18.31	1.05	10.00
	23.30	13.14	0.63	18.95	0.31	12.00
	66.50	49.08	6.76	25.70	3.26	14.00
	40.00	29.30	2.43	28.13	1.17	16.00
	39.50	27.05	2.21	30.34	1.07	18.00
	33.10	21.88	1.50	31.84	0.72	20.00
	40.00	21.26	1.76	33.60	0.85	22.00
	40.00	13.70	1.13	34.74	0.55	24.00
	42.00	12.08	1.05	35.79	0.51	26.00
	41.00	10.89	0.92	36.71	0.45	28.00
	40.00	10.39	0.86	37.57	0.42	30.00
	24.20	9.51	0.48	38.05	0.23	32.00
Wash	80.30	17.08	2.84	40.89	1.37	
Carbon	7.93	3.60	59.11	100.00	28.55	
	7.93 (grams)	6.09 (mg/g)	100.00		48.30	

Test No. 51

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
5% ethanol
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	Cum.	Metal Unit	B.V. cum.
	37.80	0.15	0.01	0.01	0.01	2.00
	33.20	1.20	0.07	0.08	0.04	4.00
	37.80	1.23	0.08	0.15	0.05	6.00
	41.50	1.45	0.10	0.26	0.06	8.00
	42.30	1.50	0.11	0.36	0.06	10.00
	35.60	1.54	0.09	0.45	0.05	12.00
	43.90	1.48	0.11	0.56	0.06	14.00
	39.90	1.57	0.11	0.67	0.06	16.00
	46.50	1.32	0.10	0.77	0.06	18.00
	49.50	1.37	0.11	0.89	0.07	20.00
	44.80	1.60	0.12	1.01	0.07	22.00
	38.10	1.34	0.09	1.09	0.05	24.00
	50.00	1.39	0.12	1.21	0.07	26.00
	40.00	1.44	0.10	1.30	0.06	28.00
	40.00	1.45	0.10	1.40	0.06	30.00
	37.90	1.40	0.09	1.49	0.05	32.00
	40.00	1.42	0.10	1.59	0.06	34.00
	44.10	1.44	0.11	1.69	0.06	36.00
Wash	92.00	1.07	0.17	1.86	0.10	
Carbon	10.57	5.53	98.14	100.00	58.45	
	10.57 (grams)	5.63 (mg/g)	100.00		59.56	

Test No. 52

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
10% ethanol
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	17.30	0.03	0.00	0.00	0.00	2.00
	42.90	1.38	0.12	0.12	0.06	4.00
	31.50	2.77	0.17	0.29	0.09	6.00
	35.50	2.69	0.19	0.49	0.10	8.00
	40.00	2.74	0.22	0.71	0.11	10.00
	39.70	2.99	0.24	0.94	0.12	12.00
	35.10	2.82	0.20	1.14	0.10	14.00
	43.30	2.80	0.24	1.39	0.12	16.00
	46.50	2.68	0.25	1.64	0.12	18.00
	40.00	2.51	0.20	1.84	0.10	20.00
	44.60	2.69	0.24	2.08	0.12	22.00
	40.10	2.86	0.23	2.31	0.11	24.00
	38.90	2.93	0.23	2.54	0.11	26.00
	40.00	2.82	0.23	2.76	0.11	28.00
	40.00	2.83	0.23	2.99	0.11	30.00
	42.00	2.82	0.24	3.23	0.12	32.00
	46.20	2.79	0.26	3.49	0.13	34.00
	41.50	2.85	0.24	3.72	0.12	36.00
	24.90	2.81	0.14	3.86	0.07	38.00
Wash	120.00	0.48	0.12	3.98	0.06	
Carbon	9.37	5.11	96.02	100.00	47.88	
	9.37 (grams)	5.32 (mg/g)	100.00		49.86	

Test No. 53

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
20% ethanol
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution		Metal Unit	B.V. cum.
			Ind.	Cum.		
	12.20	0.04	0.00	0.00	0.00	2.00
	55.00	5.68	0.59	0.59	0.31	4.00
	41.20	10.04	0.78	1.37	0.41	6.00
	40.20	10.28	0.78	2.14	0.41	8.00
	40.00	10.45	0.79	2.93	0.42	10.00
	47.00	10.40	0.92	3.85	0.49	12.00
	46.20	10.43	0.91	4.76	0.48	14.00
	44.90	10.37	0.88	5.63	0.47	16.00
	42.30	10.41	0.83	6.46	0.44	18.00
	47.00	8.73	0.77	7.23	0.41	20.00
	45.50	9.23	0.79	8.02	0.42	22.00
	42.00	9.65	0.76	8.79	0.41	24.00
	38.20	10.04	0.72	9.51	0.38	26.00
	40.00	10.15	0.76	10.27	0.41	28.00
	40.30	10.21	0.77	11.05	0.41	30.00
	43.00	10.00	0.81	11.86	0.43	32.00
	44.70	10.06	0.85	12.70	0.45	34.00
	40.30	9.64	0.73	13.43	0.39	36.00
	26.40	9.69	0.48	13.91	0.26	38.00
Wash	75.00	2.65	0.37	14.29	0.20	
Carbon	9.55	4.77	85.71	100.00	45.55	
	9.55 (grams)	5.57 (mg/g)	100.00		53.15	

Test No. 54

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
5% butanol
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	40.00	3.86	0.36	0.36	0.15	2.00
	40.20	60.30	5.72	6.08	2.42	4.00
	40.00	93.20	8.80	14.88	3.73	6.00
	40.00	97.20	9.17	24.05	3.89	8.00
	40.00	70.80	6.68	30.73	2.83	10.00
	40.00	55.10	5.20	35.93	2.20	12.00
	40.00	46.30	4.37	40.30	1.85	14.00
	40.50	43.20	4.13	44.43	1.75	16.00
	40.00	40.50	3.82	48.25	1.62	18.00
	40.00	39.30	3.71	51.96	1.57	20.00
	25.00	38.59	2.28	54.24	0.96	22.00
	40.00	43.20	4.08	58.31	1.73	24.00
	39.10	29.46	2.72	61.03	1.15	26.00
	52.30	37.88	4.67	65.71	1.98	28.00
	40.00	23.19	2.19	67.89	0.93	30.00
	40.80	21.59	2.08	69.97	0.88	32.00
	40.50	9.21	0.88	70.85	0.37	34.00
	45.00	10.54	1.12	71.97	0.47	36.00
	40.30	11.78	1.12	73.09	0.47	38.00
	40.00	10.37	0.98	74.07	0.41	40.00
	43.80	8.26	0.85	74.92	0.36	42.00
	45.30	10.04	1.07	76.00	0.45	44.00
	35.50	5.27	0.44	76.44	0.19	46.00
Wash	95.00	3.15	0.71	77.14	0.30	
Carbon	8.21	1.18	22.86	100.00	9.69	
	8.21 (grams)	5.16 (mg/g)	100.00		42.39	

Test No. 55

Conditions: 50 g/L thiourea, 75 g/L sulphuric acid
5% butanol
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	41.40	1.40	0.13	0.13	0.06	2.00
	40.00	80.10	7.42	7.55	3.20	4.00
	40.80	99.60	9.41	16.96	4.06	6.00
	40.50	90.20	8.46	25.42	3.65	8.00
	40.00	84.60	7.83	33.25	3.38	10.00
	40.10	77.90	7.23	40.49	3.12	12.00
	40.00	64.60	5.98	46.47	2.58	14.00
	40.00	58.50	5.42	51.89	2.34	16.00
	40.00	45.04	4.17	56.06	1.80	18.00
	40.00	39.58	3.67	59.72	1.58	20.00
	20.00	46.14	2.14	61.86	0.92	22.00
	40.00	32.81	3.04	64.90	1.31	24.00
	40.00	44.81	4.15	69.05	1.79	26.00
	50.10	24.78	2.87	71.92	1.24	28.00
	40.30	20.20	1.88	73.81	0.81	30.00
	40.20	19.19	1.79	75.59	0.77	32.00
	40.00	10.25	0.95	76.54	0.41	34.00
	43.00	9.74	0.97	77.51	0.42	36.00
	40.80	10.11	0.96	78.47	0.41	38.00
	40.50	9.00	0.84	79.31	0.36	40.00
	42.50	7.55	0.74	80.05	0.32	42.00
	41.60	9.49	0.91	80.97	0.39	44.00
	27.00	5.60	0.35	81.32	0.15	46.00
Wash	85.00	3.32	0.65	81.97	0.28	
Carbon	7.71	1.01	18.03	100.00	7.79	
	7.71 (grams)	5.60 (mg/g)	100.00		43.19	

Test No. 56

Conditions: 50 g/L thiourea, 100 g/L sulphuric acid
5% butanol
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	3.67	0.32	0.32	0.15	2.00
	40.00	43.25	3.75	4.07	1.73	4.00
	40.60	70.84	6.23	10.29	2.88	6.00
	40.70	88.59	7.81	18.10	3.61	8.00
	40.10	71.87	6.24	24.35	2.88	10.00
	40.80	77.45	6.84	31.19	3.16	12.00
	40.00	74.94	6.49	37.68	3.00	14.00
	40.50	69.67	6.11	43.80	2.82	16.00
	40.00	59.49	5.15	48.95	2.38	18.00
	40.00	49.75	4.31	53.26	1.99	20.00
	30.00	42.53	2.76	56.02	1.28	22.00
	41.30	57.02	5.10	61.12	2.35	24.00
	40.50	45.86	4.02	65.15	1.86	26.00
	52.50	31.12	3.54	68.69	1.63	28.00
	40.50	31.23	2.74	71.42	1.26	30.00
	40.00	22.34	1.94	73.36	0.89	32.00
	40.00	17.65	1.53	74.89	0.71	34.00
	38.60	15.68	1.31	76.20	0.61	36.00
	39.50	13.42	1.15	77.35	0.53	38.00
	40.70	11.31	1.00	78.35	0.46	40.00
	42.40	11.95	1.10	79.44	0.51	42.00
	40.30	5.89	0.51	79.96	0.24	44.00
	35.20	6.14	0.47	80.43	0.22	46.00
Wash	92.00	7.58	1.51	81.94	0.70	
Carbon	8.34	1.00	18.06	100.00	8.34	
	8.34 (grams)	5.54 (mg/g)	100.00		46.17	

Test No. 58

Conditions: 100 g/L thiourea, 100 g/L sulphuric acid
5% butanol
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	40.10	0.95	0.08	0.08	0.04	2.00
	40.30	45.57	4.05	4.14	1.84	4.00
	40.00	80.17	7.07	11.21	3.21	6.00
	40.30	80.96	7.20	18.41	3.26	8.00
	40.00	75.17	6.63	25.04	3.01	10.00
	40.00	73.96	6.53	31.57	2.96	12.00
	40.00	71.45	6.30	37.87	2.86	14.00
	40.60	69.56	6.23	44.10	2.82	16.00
	40.00	62.06	5.48	49.58	2.48	18.00
	40.00	54.11	4.77	54.35	2.16	20.00
	45.00	36.89	3.66	58.02	1.66	22.00
	42.40	61.68	5.77	63.79	2.62	24.00
	40.30	48.12	4.28	68.06	1.94	26.00
	52.00	36.01	4.13	72.19	1.87	28.00
	40.00	29.82	2.63	74.83	1.19	30.00
	40.10	27.21	2.41	77.23	1.09	32.00
	40.50	15.68	1.40	78.63	0.64	34.00
	42.00	13.80	1.28	79.91	0.58	36.00
	40.50	11.66	1.04	80.95	0.47	38.00
	39.80	11.27	0.99	81.94	0.45	40.00
	40.50	9.26	0.83	82.77	0.38	42.00
	41.00	10.38	0.94	83.71	0.43	44.00
	27.00	4.92	0.29	84.00	0.13	46.00
Wash	95.00	4.00	0.84	84.84	0.38	
Carbon	8.18	0.84	15.16	100.00	6.87	
	8.18 (grams)	5.54 (mg/g)	100.00		45.33	

Test No. 59

Conditions: 50 g/L thiouea, 50 g/L sulphuric acid
5% butanol
Two bed volume per hour at 40 deg. C.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	45.00	9.10	0.97	0.97	0.41	2.00
	41.80	219.40	21.67	22.64	9.17	4.00
	45.00	168.00	17.87	40.51	7.56	6.00
	43.00	88.30	8.97	49.48	3.80	8.00
	40.00	79.80	7.54	57.03	3.19	10.00
	40.00	69.40	6.56	63.59	2.78	12.00
	42.50	24.44	2.45	66.04	1.04	14.00
	40.00	19.08	1.80	67.85	0.76	16.00
	40.00	24.58	2.32	70.17	0.98	18.00
	40.20	15.47	1.47	71.64	0.62	20.00
	40.30	17.42	1.66	73.30	0.70	22.00
	40.00	32.64	3.09	76.38	1.31	24.00
	40.00	18.65	1.76	78.15	0.75	26.00
	41.50	14.27	1.40	79.55	0.59	28.00
	45.00	11.98	1.27	80.82	0.54	30.00
	40.00	8.26	0.78	81.60	0.33	32.00
	40.00	6.82	0.64	82.25	0.27	34.00
	40.20	6.07	0.58	82.82	0.24	36.00
	40.00	5.53	0.52	83.35	0.22	38.00
	40.00	5.42	0.51	83.86	0.22	40.00
	40.30	4.82	0.46	84.32	0.19	42.00
	62.30	7.75	1.14	85.46	0.48	44.00
	103.80	1.00	0.25	85.70	0.10	46.00
	40.30	0.83	0.08	85.78	0.03	48.00
	43.20	4.40	0.45	86.23	0.19	50.00
	45.00	4.57	0.49	86.72	0.21	52.00
	42.30	7.74	0.77	87.49	0.33	54.00
	40.00	7.99	0.76	88.25	0.32	56.00
	40.00	3.77	0.36	88.60	0.15	58.00
	40.00	2.52	0.24	88.84	0.10	60.00
	40.00	2.62	0.25	89.09	0.10	62.00
	40.50	2.41	0.23	89.32	0.10	64.00
	27.00	2.71	0.17	89.49	0.07	66.00
Wash	110.00	1.79	0.47	89.96	0.20	
Carbon	9.04	0.47	10.04	100.00	4.25	
	9.04 (grams)	4.68 (mg/g)	100.00		42.31	

Test No. 60

Conditions: 50 g/L thiouea, 50 g/L sulphuric acid
5% butanol
Two bed volume per hour at 60 deg. C.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	46.30	3.24	0.32	0.32	0.15	2.00
	40.30	77.30	6.57	6.89	3.12	4.00
	40.20	161.20	13.67	20.55	6.48	6.00
	43.50	92.70	8.50	29.06	4.03	8.00
	40.50	86.30	7.37	36.43	3.50	10.00
	40.00	85.50	7.21	43.64	3.42	12.00
	45.30	67.00	6.40	50.04	3.04	14.00
	42.50	118.70	10.64	60.68	5.04	16.00
	40.00	56.83	4.79	65.48	2.27	18.00
	40.30	46.88	3.98	69.46	1.89	20.00
	40.00	46.83	3.95	73.41	1.87	22.00
	40.20	43.64	3.70	77.11	1.75	24.00
	48.30	27.20	2.77	79.89	1.31	26.00
	40.00	24.73	2.09	81.97	0.99	28.00
	40.00	20.22	1.71	83.68	0.81	30.00
	40.00	19.95	1.68	85.36	0.80	32.00
	40.00	17.82	1.50	86.86	0.71	34.00
	40.80	7.97	0.69	87.55	0.33	36.00
	40.00	6.31	0.53	88.08	0.25	38.00
	40.00	6.59	0.56	88.64	0.26	40.00
	45.20	3.60	0.34	88.98	0.16	42.00
	60.80	2.84	0.36	89.35	0.17	44.00
	92.50	0.70	0.14	89.48	0.06	46.00
	43.10	1.33	0.12	89.60	0.06	48.00
	40.30	4.47	0.38	89.98	0.18	50.00
	40.00	11.06	0.93	90.92	0.44	52.00
	40.50	8.06	0.69	91.60	0.33	54.00
	40.00	8.10	0.68	92.29	0.32	56.00
	41.00	5.12	0.44	92.73	0.21	58.00
	42.00	5.05	0.45	93.18	0.21	60.00
	41.30	4.78	0.42	93.59	0.20	62.00
	42.00	4.53	0.40	94.00	0.19	64.00
	38.90	1.46	0.12	94.12	0.06	66.00
Wash	100.50	0.32	0.07	94.18	0.03	
Carbon	9.85	0.28	5.82	100.00	2.76	
	9.85	4.81	100.00		47.41	
	(grams)	(mg/g)				

Test No. 61

Conditions: 50 g/L thiourea, 75 g/L sulphuric acid
5% butanol
Two bed volume per hour at 40 deg. C.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	2.51	0.26	0.26	0.10	2.00
	43.00	95.80	10.68	10.95	4.12	4.00
	40.00	174.80	18.14	29.08	6.99	6.00
	40.00	120.80	12.53	41.61	4.83	8.00
	40.00	75.90	7.87	49.49	3.04	10.00
	40.40	67.00	7.02	56.51	2.71	12.00
	41.50	40.56	4.37	60.88	1.68	14.00
	40.00	29.04	3.01	63.89	1.16	16.00
	40.50	20.26	2.13	66.02	0.82	18.00
	43.30	39.66	4.45	70.47	1.72	20.00
	41.00	68.88	7.33	77.80	2.82	22.00
	40.50	31.95	3.36	81.15	1.29	24.00
	40.00	21.51	2.23	83.38	0.86	26.00
	40.00	18.22	1.89	85.28	0.73	28.00
	40.00	11.38	1.18	86.46	0.46	30.00
	40.50	7.36	0.77	87.23	0.30	32.00
	40.00	6.70	0.70	87.92	0.27	34.00
	40.00	5.34	0.55	88.48	0.21	36.00
	41.00	3.65	0.39	88.87	0.15	38.00
	40.00	3.14	0.33	89.19	0.13	40.00
	40.00	12.98	1.35	90.54	0.52	42.00
	40.00	8.77	0.91	91.45	0.35	44.00
	42.00	5.04	0.55	92.00	0.21	46.00
	40.00	3.18	0.33	92.33	0.13	48.00
	41.00	2.66	0.28	92.61	0.11	50.00
	40.00	2.06	0.21	92.82	0.08	52.00
	40.00	2.50	0.26	93.08	0.10	54.00
	40.00	2.28	0.24	93.32	0.09	56.00
	41.00	2.50	0.27	93.59	0.10	58.00
Wash	90.00	1.03	0.24	93.83	0.09	
Carbon	8.50	0.28	6.17	100.00	2.38	
	8.50 (grams)	4.54 (mg/g)	100.00		38.55	

Test No. 62

Conditions: 50 g/L thiourea, 75 g/L sulphuric acid
5% butanol
Two bed volume per hour at 60 deg. C.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	51.30	15.56	1.74	1.74	0.80	2.00
	40.40	148.80	13.08	14.81	6.01	4.00
	49.20	206.20	22.07	36.88	10.15	6.00
	43.00	157.50	14.73	51.61	6.77	8.00
	40.50	93.20	8.21	59.82	3.77	10.00
	42.90	90.50	8.45	68.27	3.88	12.00
	41.60	49.24	4.46	72.73	2.05	14.00
	45.00	38.08	3.73	76.45	1.71	16.00
	40.00	37.50	3.26	79.72	1.50	18.00
	40.00	40.14	3.49	83.21	1.61	20.00
	40.00	34.27	2.98	86.19	1.37	22.00
	46.00	17.82	1.78	87.97	0.82	24.00
	43.00	12.84	1.20	89.17	0.55	26.00
	40.00	9.83	0.86	90.03	0.39	28.00
	41.00	9.63	0.86	90.89	0.39	30.00
	40.00	10.04	0.87	91.76	0.40	32.00
	41.00	6.49	0.58	92.34	0.27	34.00
	40.00	3.76	0.33	92.67	0.15	36.00
	45.00	2.99	0.29	92.96	0.13	38.00
	45.00	1.73	0.17	93.13	0.08	40.00
	45.00	3.58	0.35	93.48	0.16	42.00
	52.00	3.04	0.34	93.82	0.16	44.00
	40.00	2.63	0.23	94.05	0.11	46.00
	40.00	2.19	0.19	94.24	0.09	48.00
	40.00	1.82	0.16	94.40	0.07	50.00
	40.00	1.09	0.09	94.50	0.04	52.00
	43.00	1.25	0.12	94.61	0.05	54.00
	44.00	0.51	0.05	94.66	0.02	56.00
	50.00	0.73	0.08	94.74	0.04	58.00
Wash	103.00	0.14	0.03	94.77	0.01	
Carbon	9.24	0.26	5.23	100.00	2.40	
	9.24 (grams)	4.98 (mg/g)	100.00		45.97	

Test No. 63

Conditions: 50 g/L thiourea, 100 g/L sulphuric acid
5% butanol
Two bed volume per hour at 60 deg. C.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	11.86	1.31	1.31	0.47	2.00
	40.50	192.90	21.57	22.88	7.81	4.00
	42.00	146.40	16.97	39.85	6.15	6.00
	40.00	138.90	15.34	55.19	5.56	8.00
	40.00	101.30	11.19	66.38	4.05	10.00
	42.50	55.80	6.55	72.92	2.37	12.00
	40.00	59.63	6.58	79.51	2.39	14.00
	41.50	33.12	3.79	83.30	1.37	16.00
	40.00	20.14	2.22	85.53	0.81	18.00
	40.00	17.04	1.88	87.41	0.68	20.00
	44.00	11.19	1.36	88.77	0.49	22.00
	40.50	14.67	1.64	90.41	0.59	24.00
	40.00	10.06	1.11	91.52	0.40	26.00
	46.00	7.86	1.00	92.52	0.36	28.00
	41.00	5.72	0.65	93.16	0.23	30.00
	40.50	6.23	0.70	93.86	0.25	32.00
	40.00	4.27	0.47	94.33	0.17	34.00
	40.00	4.22	0.47	94.80	0.17	36.00
	30.00	2.93	0.24	95.04	0.09	38.00
	40.00	2.94	0.32	95.36	0.12	40.00
	40.00	5.23	0.58	95.94	0.21	42.00
	40.00	3.10	0.34	96.28	0.12	44.00
	40.00	1.84	0.20	96.49	0.07	46.00
	40.00	1.20	0.13	96.62	0.05	48.00
	41.00	1.01	0.11	96.73	0.04	50.00
	41.00	1.57	0.18	96.91	0.06	52.00
	41.00	1.27	0.14	97.06	0.05	54.00
	45.00	1.12	0.14	97.19	0.05	56.00
	40.00	0.92	0.10	97.30	0.04	58.00
Wash	95.00	0.20	0.05	97.35	0.02	
Carbon	6.86	0.14	2.65	100.00	0.96	
	6.86 (grams)	5.28 (mg/g)	100.00		36.22	

Test No. 64

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
10% butanol, 10% acetone
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	53.54	4.92	4.92	2.14	2.00
	38.90	197.60	17.66	22.59	7.69	4.00
	40.50	143.40	13.35	35.93	5.81	6.00
	40.00	79.70	7.33	43.26	3.19	8.00
	40.00	58.00	5.33	48.59	2.32	10.00
	40.00	48.61	4.47	53.06	1.94	12.00
	42.00	39.42	3.80	56.86	1.66	14.00
	40.00	28.24	2.60	59.46	1.13	16.00
	41.00	24.62	2.32	61.78	1.01	18.00
	41.00	66.40	6.26	68.03	2.72	20.00
	48.00	60.61	6.69	74.72	2.91	22.00
	40.00	16.69	1.53	76.25	0.67	24.00
	40.00	17.29	1.59	77.84	0.69	26.00
	40.00	11.49	1.06	78.90	0.46	28.00
	40.00	8.94	0.82	79.72	0.36	30.00
	40.00	9.71	0.89	80.61	0.39	32.00
	40.00	12.17	1.12	81.73	0.49	34.00
	40.00	6.30	0.58	82.31	0.25	36.00
	47.00	9.47	1.02	83.33	0.45	38.00
	40.00	25.39	2.33	85.67	1.02	40.00
	40.00	25.59	2.35	88.02	1.02	42.00
	40.00	11.67	1.07	89.09	0.47	44.00
	40.00	4.08	0.38	89.47	0.16	46.00
	40.00	2.42	0.22	89.69	0.10	48.00
	40.00	2.46	0.23	89.92	0.10	50.00
	40.00	2.34	0.22	90.13	0.09	52.00
	40.00	2.20	0.20	90.33	0.09	54.00
	40.00	4.21	0.39	90.72	0.17	56.00
	40.00	2.57	0.24	90.96	0.10	58.00
	40.00	2.17	0.20	91.16	0.09	60.00
Wash	95.00	1.81	0.40	91.55	0.17	
Carbon	8.55	0.43	8.45	100.00	3.68	
	8.55 (grams)	5.09 (mg/g)	100.00		43.52	

Test No. 67

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
30% acetone
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	35.59	3.05	3.05	1.42	2.00
	40.00	28.84	2.47	5.52	1.15	4.00
	40.00	39.41	3.38	8.90	1.58	6.00
	40.00	39.62	3.39	12.29	1.58	8.00
	40.00	39.70	3.40	15.69	1.59	10.00
	41.00	43.35	3.81	19.50	1.78	12.00
	41.00	41.40	3.64	23.14	1.70	14.00
	40.00	32.82	2.81	25.95	1.31	16.00
	40.00	39.28	3.37	29.31	1.57	18.00
	40.00	49.45	4.24	33.55	1.98	20.00
	40.00	42.85	3.67	37.22	1.71	22.00
	40.00	38.15	3.27	40.49	1.53	24.00
	40.00	31.81	2.73	43.22	1.27	26.00
	40.00	33.22	2.85	46.06	1.33	28.00
	40.00	25.01	2.14	48.21	1.00	30.00
	40.00	25.08	2.15	50.36	1.00	32.00
	40.00	23.12	1.98	52.34	0.92	34.00
	41.00	22.76	2.00	54.33	0.93	36.00
	40.00	21.56	1.85	56.18	0.86	38.00
	38.00	20.57	1.67	57.86	0.78	40.00
	40.00	20.44	1.75	59.61	0.82	42.00
	41.00	13.98	1.23	60.84	0.57	44.00
	40.00	13.54	1.16	62.00	0.54	46.00
	40.00	12.96	1.11	63.11	0.52	48.00
	40.00	11.97	1.03	64.13	0.48	50.00
	40.00	11.25	0.96	65.10	0.45	52.00
	40.00	10.18	0.87	65.97	0.41	54.00
	40.00	10.19	0.87	66.84	0.41	56.00
	41.00	8.98	0.79	67.63	0.37	58.00
	40.00	8.94	0.77	68.40	0.36	60.00
Wash	60.00	2.11	0.27	68.67	0.13	
Carbon	7.54	1.94	31.33	100.00	14.63	
	7.54 (grams)	6.19 (mg/g)	100.00		46.68	

Test No. 68

Conditions: 100 g/L thiourea, 50 g/L sulphuric acid
5% butanol
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	40.00	15.75	1.56	1.56	0.63	2.00
	40.00	31.08	3.07	4.63	1.24	4.00
	40.00	84.80	8.39	13.02	3.39	6.00
	40.00	91.90	9.09	22.11	3.68	8.00
	40.50	88.20	8.83	30.94	3.57	10.00
	40.00	80.20	7.93	38.87	3.21	12.00
	40.00	62.36	6.17	45.04	2.49	14.00
	40.00	78.13	7.73	52.77	3.13	16.00
	40.00	62.91	6.22	58.99	2.52	18.00
	41.00	41.05	4.16	63.15	1.68	20.00
	40.00	29.36	2.90	66.05	1.17	22.00
	40.00	20.86	2.06	68.12	0.83	24.00
	40.00	16.55	1.64	69.75	0.66	26.00
	40.00	27.69	2.74	72.49	1.11	28.00
	40.00	21.73	2.15	74.64	0.87	30.00
	40.00	19.75	1.95	76.59	0.79	32.00
	40.00	13.76	1.36	77.96	0.55	34.00
	40.00	13.07	1.29	79.25	0.52	36.00
	40.00	11.24	1.11	80.36	0.45	38.00
	40.00	11.50	1.14	81.50	0.46	40.00
	40.00	10.88	1.08	82.57	0.44	42.00
	40.00	16.44	1.63	84.20	0.66	44.00
	40.00	11.97	1.18	85.38	0.48	46.00
	40.00	8.48	0.84	86.22	0.34	48.00
	40.00	6.84	0.68	86.90	0.27	50.00
	41.00	5.58	0.57	87.46	0.23	52.00
	40.00	6.29	0.62	88.09	0.25	54.00
	42.00	3.79	0.39	88.48	0.16	56.00
	40.00	4.43	0.44	88.92	0.18	58.00
Wash	60.00	1.81	0.27	89.19	0.11	
Carbon	7.81	0.56	10.81	100.00	4.37	
	7.81 (grams)	5.18 (mg/g)	100.00		40.44	

Test No. 69

Conditions: 50 g/L thiourea, 100 g/L sulphuric acid
5% butanol
Two bed volume per hour at 60 deg. C.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	0.16	0.02	0.02	0.01	2.00
	40.00	182.70	18.87	18.89	7.31	4.00
	40.00	243.70	25.17	44.06	9.75	6.00
	40.00	123.30	12.73	56.79	4.93	8.00
	40.00	78.50	8.11	64.90	3.14	10.00
	40.00	78.20	8.08	72.98	3.13	12.00
	40.00	62.08	6.41	79.39	2.48	14.00
	40.00	38.45	3.97	83.36	1.54	16.00
	40.00	27.80	2.87	86.23	1.11	18.00
	43.00	29.03	3.22	89.45	1.25	20.00
	40.00	17.08	1.76	91.22	0.68	22.00
	40.00	6.32	0.65	91.87	0.25	24.00
	40.00	6.16	0.64	92.51	0.25	26.00
	40.00	4.87	0.50	93.01	0.19	28.00
	40.00	14.19	1.47	94.47	0.57	30.00
	40.00	9.03	0.93	95.41	0.36	32.00
	42.00	4.30	0.47	95.87	0.18	34.00
	40.00	6.02	0.62	96.50	0.24	36.00
	40.00	3.09	0.32	96.81	0.12	38.00
	40.00	2.85	0.29	97.11	0.11	40.00
	40.00	1.68	0.17	97.28	0.07	42.00
	40.00	1.61	0.17	97.45	0.06	44.00
	41.00	1.67	0.18	97.63	0.07	46.00
	41.00	0.72	0.08	97.70	0.03	48.00
	40.00	0.71	0.07	97.77	0.03	50.00
	40.00	0.40	0.04	97.82	0.02	52.00
	40.00	0.36	0.04	97.85	0.01	54.00
	40.00	0.27	0.03	97.88	0.01	56.00
	40.00	0.25	0.03	97.91	0.01	58.00
	40.00	0.22	0.02	97.93	0.01	60.00
	40.00	0.35	0.04	97.97	0.01	62.00
	40.00	0.19	0.02	97.99	0.01	64.00
	45.00	0.25	0.03	98.01	0.01	66.00
Wash	60.00	0.02	0.00	98.02	0.00	
Carbon	8.53	0.09	1.98	100.00	0.77	
	8.53 (grams)	4.54 (mg/g)	100.00		38.73	

Test No. 70

Conditions: 100 g/L thiourea, 100 g/L sulphuric acid
5% butanol
Two bed volume per hour at 40 deg. C.

	Volume ml	Assay Au, mg/L	% Distribution Ind.	% Distribution Cum.	Metal Unit	B.V. cum.
	40.00	0.45	0.04	0.04	0.02	2.00
	40.00	64.90	5.51	5.55	2.60	4.00
	40.00	129.10	10.96	16.51	5.16	6.00
	40.00	117.60	9.98	26.49	4.70	8.00
	40.00	74.80	6.35	32.84	2.99	10.00
	40.00	77.10	6.54	39.38	3.08	12.00
	43.50	76.53	7.06	46.45	3.33	14.00
	40.00	71.08	6.03	52.48	2.84	16.00
	40.00	53.50	4.54	57.02	2.14	18.00
	40.00	79.29	6.73	63.75	3.17	20.00
	40.00	49.98	4.24	68.00	2.00	22.00
	37.00	35.91	2.82	70.82	1.33	24.00
	40.00	21.83	1.85	72.67	0.87	26.00
	40.00	14.44	1.23	73.89	0.58	28.00
	40.00	24.76	2.10	76.00	0.99	30.00
	40.00	30.52	2.59	78.59	1.22	32.00
	40.00	21.40	1.82	80.40	0.86	34.00
	40.00	13.82	1.17	81.58	0.55	36.00
	42.00	14.75	1.31	82.89	0.62	38.00
	40.00	16.35	1.39	84.28	0.65	40.00
	40.00	13.81	1.17	85.45	0.55	42.00
	40.00	15.72	1.33	86.79	0.63	44.00
	40.00	16.71	1.42	88.20	0.67	46.00
	40.00	16.47	1.40	89.60	0.66	48.00
	41.00	13.11	1.14	90.74	0.54	50.00
	40.00	9.00	0.76	91.51	0.36	52.00
	40.00	6.06	0.51	92.02	0.24	54.00
	40.00	4.76	0.40	92.42	0.19	56.00
	40.00	3.77	0.32	92.74	0.15	58.00
	41.00	2.36	0.21	92.95	0.10	60.00
	40.00	2.50	0.21	93.16	0.10	62.00
	43.00	1.53	0.14	93.30	0.07	64.00
Wash	60.00	0.30	0.04	93.34	0.02	
Carbon	9.23	0.34	6.66	100.00	3.14	
	9.23 (grams)	5.11 (mg/g)	100.00		47.12	

Test No. 71

Conditions: 100 g/L thiourea, 100 g/L sulphuric acid
5% butanol
Two bed volume per hour at 60 deg. C.

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	40.00	16.22	1.81	1.81	0.65	2.00
	40.00	144.40	16.12	17.93	5.78	4.00
	40.00	266.70	29.77	47.70	10.67	6.00
	42.00	120.90	14.17	61.87	5.08	8.00
	41.00	95.50	10.93	72.80	3.92	10.00
	40.50	67.30	7.61	80.41	2.73	12.00
	40.00	54.34	6.07	86.47	2.17	14.00
	50.00	28.03	3.91	90.38	1.40	16.00
	40.00	13.99	1.56	91.95	0.56	18.00
	80.00	11.42	2.55	94.50	0.91	20.00
	40.00	12.10	1.35	95.85	0.48	22.00
	40.00	4.99	0.56	96.40	0.20	24.00
	40.00	3.08	0.34	96.75	0.12	26.00
	42.50	6.98	0.83	97.57	0.30	28.00
	40.00	6.55	0.73	98.31	0.26	30.00
	40.00	2.83	0.32	98.62	0.11	32.00
	40.00	1.84	0.21	98.83	0.07	34.00
	40.00	1.19	0.13	98.96	0.05	36.00
	40.00	0.80	0.09	99.05	0.03	38.00
	40.00	0.75	0.08	99.13	0.03	40.00
	41.00	0.77	0.09	99.22	0.03	42.00
	41.00	0.57	0.07	99.29	0.02	44.00
	40.00	0.45	0.05	99.34	0.02	46.00
	41.00	0.43	0.05	99.39	0.02	48.00
	41.00	0.44	0.05	99.44	0.02	50.00
	42.00	0.28	0.03	99.47	0.01	52.00
	41.00	0.27	0.03	99.50	0.01	54.00
	40.50	0.27	0.03	99.53	0.01	56.00
	40.00	0.22	0.02	99.56	0.01	58.00
	40.00	0.21	0.02	99.58	0.01	60.00
	40.00	0.11	0.01	99.59	0.00	62.00
Wash	70.00	0.02	0.00	99.59	0.00	
Carbon	7.26	0.02	0.41	100.00	0.15	
	7.26 (grams)	4.94 (mg/g)	100.00		35.83	

Test No. 72

Conditions: 100 g/L thiourea, 100 g/L sulphuric acid
50% Acetone
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution		Metal Unit	B.V. cum.
			Ind.	Cum.		
	40.00	125.60	7.75	7.75	5.02	2.00
	40.00	236.90	14.62	22.37	9.48	4.00
	40.00	176.10	10.87	33.24	7.04	6.00
	40.00	166.50	10.28	43.51	6.66	8.00
	40.00	103.60	6.39	49.91	4.14	10.00
	40.50	94.40	5.90	55.81	3.82	12.00
	40.00	93.40	5.76	61.57	3.74	14.00
	40.00	66.20	4.09	65.66	2.65	16.00
	40.00	48.90	3.02	68.67	1.96	18.00
	40.00	35.90	2.22	70.89	1.44	20.00
	40.00	33.30	2.06	72.94	1.33	22.00
	45.00	34.10	2.37	75.31	1.53	24.00
	40.00	34.30	2.12	77.43	1.37	26.00
	40.00	33.40	2.06	79.49	1.34	28.00
	40.00	29.60	1.83	81.32	1.18	30.00
	40.00	24.10	1.49	82.80	0.96	32.00
	40.00	16.10	0.99	83.80	0.64	34.00
	40.00	15.90	0.98	84.78	0.64	36.00
	40.00	21.70	1.34	86.12	0.87	38.00
	40.00	16.70	1.03	87.15	0.67	40.00
	40.00	15.80	0.98	88.12	0.63	42.00
	40.00	8.10	0.50	88.62	0.32	44.00
	41.50	7.61	0.49	89.11	0.32	46.00
	48.00	2.40	0.18	89.29	0.12	48.00
	40.00	1.90	0.12	89.41	0.08	50.00
	40.00	2.40	0.15	89.55	0.10	52.00
	40.00	4.30	0.27	89.82	0.17	54.00
	40.00	10.09	0.62	90.44	0.40	56.00
	41.00	11.01	0.70	91.14	0.45	58.00
	40.00	9.60	0.59	91.73	0.38	60.00
	40.00	9.10	0.56	92.29	0.36	62.00
Wash	60.00	6.89	0.64	92.93	0.41	
Carbon	7.90	0.58	7.07	100.00	4.58	
	7.90 (grams)	8.20 (mg/g)	100.00		64.82	

Test No. 73

Conditions: 50 g/L thiourea, 50 g/L sulphuric acid
50% acetonitrile
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	33.30	2.43	2.43	1.33	2.00
	40.00	273.10	19.94	22.37	10.92	4.00
	40.00	231.40	16.90	39.27	9.26	6.00
	48.50	157.70	13.96	53.23	7.65	8.00
	42.00	126.90	9.73	62.96	5.33	10.00
	40.00	80.40	5.87	68.83	3.22	12.00
	41.00	53.90	4.03	72.87	2.21	14.00
	41.50	41.10	3.11	75.98	1.71	16.00
	40.00	29.70	2.17	78.15	1.19	18.00
	40.00	26.40	1.93	80.08	1.06	20.00
	40.00	24.80	1.81	81.89	0.99	22.00
	41.00	25.60	1.92	83.81	1.05	24.00
	40.00	24.70	1.80	85.61	0.99	26.00
	40.00	22.50	1.64	87.25	0.90	28.00
	40.00	18.80	1.37	88.63	0.75	30.00
	41.00	18.10	1.35	89.98	0.74	32.00
	40.00	6.60	0.48	90.46	0.26	34.00
	41.00	5.20	0.39	90.85	0.21	36.00
	42.00	10.70	0.82	91.67	0.45	38.00
	40.00	11.00	0.80	92.48	0.44	40.00
	41.00	5.90	0.44	92.92	0.24	42.00
	40.00	9.40	0.69	93.60	0.38	44.00
	40.00	9.32	0.68	94.28	0.37	46.00
	40.00	4.01	0.29	94.58	0.16	48.00
	40.00	2.40	0.18	94.75	0.10	50.00
	40.00	2.00	0.15	94.90	0.08	52.00
	40.00	1.37	0.10	95.00	0.05	54.00
	41.00	4.40	0.33	95.33	0.18	56.00
	40.00	5.50	0.40	95.73	0.22	58.00
	42.00	3.70	0.28	96.01	0.16	60.00
	40.00	4.90	0.36	96.37	0.20	62.00
	40.00	3.50	0.26	96.63	0.14	64.00
Wash	90.00	1.03	0.17	96.80	0.09	
Carbon	8.36	0.21	3.20	100.00	1.76	
	8.36 (grams)	6.55 (mg/g)	100.00		54.78	

Test No. 74

Conditions: 50 g/L sodium thiosulphate (0.2 mole)
At room temperature
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	Cum.	Metal Unit	B.V. cum.
	40.00	2.10	0.16	0.16	0.08	2.00
	40.00	6.96	0.53	0.69	0.28	4.00
	40.00	10.01	0.76	1.45	0.40	6.00
	73.00	21.21	2.94	4.38	1.55	8.00
	40.00	25.46	1.93	6.32	1.02	10.00
	40.00	28.31	2.15	8.47	1.13	12.00
	40.00	33.23	2.52	10.99	1.33	14.00
	40.00	58.30	4.42	15.41	2.33	16.00
	40.50	62.60	4.81	20.22	2.54	18.00
	40.00	69.60	5.28	25.50	2.78	20.00
	40.00	67.40	5.12	30.62	2.70	22.00
	40.00	68.40	5.19	35.81	2.74	24.00
	40.00	74.90	5.68	41.50	3.00	26.00
	42.00	69.80	5.56	47.06	2.93	28.00
	40.00	68.90	5.23	52.29	2.76	30.00
	40.00	49.10	3.73	56.01	1.96	32.00
	43.00	45.30	3.70	59.71	1.95	34.00
	41.50	42.30	3.33	63.04	1.76	36.00
	40.00	41.50	3.15	66.19	1.66	38.00
	40.00	48.70	3.70	69.89	1.95	40.00
	40.00	40.20	3.05	72.94	1.61	42.00
	40.00	33.94	2.58	75.51	1.36	44.00
	40.00	32.23	2.45	77.96	1.29	46.00
	40.00	39.14	2.97	80.93	1.57	48.00
	40.00	48.34	3.67	84.60	1.93	50.00
	40.00	27.73	2.10	86.70	1.11	52.00
	40.00	16.71	1.27	87.97	0.67	54.00
	42.00	12.39	0.99	88.96	0.52	56.00
	42.00	15.26	1.22	90.17	0.64	58.00
	40.00	12.66	0.96	91.13	0.51	60.00
	41.00	9.41	0.73	91.87	0.39	62.00
	40.00	10.01	0.76	92.63	0.40	64.00
	40.00	7.20	0.55	93.17	0.29	66.00
	40.00	6.81	0.52	93.69	0.27	68.00
Wash	80.00	8.82	1.34	95.03	0.71	
Carbon	8.19	0.32	4.97	100.00	2.62	
	8.19 (grams)	6.44 (mg/g)	100.00		52.71	

Test No. 75

Conditions: 50 g/L Sodium Thiosulphate
50 Deg. C.
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	2.11	0.16	0.16	0.08	2.00
	40.00	16.54	1.23	1.38	0.66	4.00
	41.00	49.59	3.77	5.15	2.03	6.00
	41.00	49.32	3.75	8.90	2.02	8.00
	56.00	130.20	13.51	22.41	7.29	10.00
	40.00	110.40	8.18	30.59	4.42	12.00
	40.00	110.10	8.16	38.75	4.40	14.00
	40.00	102.40	7.59	46.34	4.10	16.00
	40.00	85.80	6.36	52.70	3.43	18.00
	40.00	85.20	6.32	59.02	3.41	20.00
	40.50	85.50	6.42	65.43	3.46	22.00
	40.00	73.50	5.45	70.88	2.94	24.00
	40.00	68.48	5.08	75.96	2.74	26.00
	40.00	72.89	5.40	81.36	2.92	28.00
	40.00	47.83	3.55	84.90	1.91	30.00
	40.00	47.22	3.50	88.40	1.89	32.00
	41.50	36.94	2.84	91.24	1.53	34.00
	40.00	33.44	2.48	93.72	1.34	36.00
	40.00	11.84	0.88	94.60	0.47	38.00
	40.00	9.68	0.72	95.32	0.39	40.00
	40.50	9.82	0.74	96.06	0.40	42.00
	40.00	6.69	0.50	96.55	0.27	44.00
	40.00	5.35	0.40	96.95	0.21	46.00
	42.00	2.53	0.20	97.14	0.11	48.00
	40.00	2.18	0.16	97.31	0.09	50.00
	40.00	1.65	0.12	97.43	0.07	52.00
	40.00	1.83	0.14	97.56	0.07	54.00
	40.00	1.99	0.15	97.71	0.08	56.00
	40.00	1.95	0.14	97.86	0.08	58.00
	40.00	1.28	0.09	97.95	0.05	60.00
	40.00	1.61	0.12	98.07	0.06	62.00
Wash	90.00	0.84	0.14	98.21	0.08	
Carbon	7.43	0.13	1.79	100.00	0.97	
	7.43	7.26	100.00		53.97	
	(grams)	(mg/g)				

Test No. 76

Conditions: 5% butanol
50 g/L thiourea, 100 g/L sulphuric acid
Two bed volume per hour
40 deg. C

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	40.00	37.16	3.25	3.25	1.49	2.00
	40.00	90.90	7.94	11.19	3.64	4.00
	40.00	174.20	15.22	26.41	6.97	6.00
	40.00	175.30	15.32	41.72	7.01	8.00
	40.00	105.10	9.18	50.91	4.20	10.00
	40.00	74.50	6.51	57.42	2.98	12.00
	40.00	59.60	5.21	62.62	2.38	14.00
	40.00	66.87	5.84	68.47	2.67	16.00
	60.00	22.38	2.93	71.40	1.34	18.00
	40.00	18.62	1.63	73.03	0.74	20.00
	40.00	23.14	2.02	75.05	0.93	22.00
	40.00	30.44	2.66	77.71	1.22	24.00
	40.00	15.00	1.31	79.02	0.60	26.00
	40.00	14.66	1.28	80.30	0.59	28.00
	40.00	16.36	1.43	81.73	0.65	30.00
	40.00	14.59	1.27	83.00	0.58	32.00
	40.00	14.32	1.25	84.25	0.57	34.00
	40.00	16.11	1.41	85.66	0.64	36.00
	40.00	12.91	1.13	86.79	0.52	38.00
	46.00	12.34	1.24	88.03	0.57	40.00
	40.00	15.75	1.38	89.40	0.63	42.00
	40.00	12.06	1.05	90.46	0.48	44.00
	40.00	8.25	0.72	91.18	0.33	46.00
	40.00	7.37	0.64	91.82	0.29	48.00
	40.00	5.31	0.46	92.29	0.21	50.00
	40.00	5.20	0.45	92.74	0.21	52.00
	40.00	4.28	0.37	93.11	0.17	54.00
	40.00	3.85	0.34	93.45	0.15	56.00
	40.00	2.04	0.18	93.63	0.08	58.00
	60.00	2.52	0.33	93.96	0.15	60.00
Wash	80.00	1.02	0.18	94.14	0.08	
Carbon	9.94	0.27	5.86	100.00	2.68	
	9.94 (grams)	4.61 (mg/g)	100.00		45.78	

Test No. 77

Conditions: 1 g/L NaCN, 10 g/L NaOH
140 deg. C
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	62.00	73.30	8.86	8.86	4.54	1.50
	50.00	95.00	9.26	18.11	4.75	3.00
	100.00	109.70	21.38	39.49	10.97	5.50
	100.00	22.20	4.33	43.81	2.22	8.00
	100.00	19.80	3.86	47.67	1.98	10.50
	100.00	11.30	2.20	49.87	1.13	13.00
	105.00	9.07	1.86	51.73	0.95	15.50
	100.00	8.35	1.63	53.35	0.84	18.00
	100.00	7.42	1.45	54.80	0.74	20.50
	100.00	8.68	1.69	56.49	0.87	23.00
Wash 1	200.00	7.77	3.03	59.52	1.55	
Wash 2	200.00	2.17	0.85	60.37	0.43	
Wash 3	160.00	0.99	0.31	60.67	0.16	
Carbon	19.04	1.06	39.33	100.00	20.18	
	19.04	2.70	100.00		51.32	
	(grams)	(mg/g)				

Test No. 78

Conditions: 2 g/L NaCN, 10 g/L NaOH
140 deg. C
Two bed volume per hour

	Volume ml	Assay Au, mg/L	% Distribution Ind.	 Cum.	Metal Unit	B.V. cum.
	40.00	66.74	4.93	4.93	2.67	1.00
	40.00	91.80	6.78	11.71	3.67	2.00
	80.00	123.70	18.27	29.97	9.90	4.00
	80.00	90.30	13.33	43.31	7.22	6.00
	80.00	60.26	8.90	52.20	4.82	8.00
	80.00	28.59	4.22	56.42	2.29	10.00
	80.00	18.72	2.76	59.19	1.50	12.00
	80.00	14.08	2.08	61.27	1.13	14.00
Wash 1	160.00	7.91	2.34	63.60	1.27	
Wash 2	160.00	2.68	0.79	64.40	0.43	
Wash 3	250.00	1.39	0.64	65.04	0.35	
Carbon	23.10	0.82	34.96	100.00	18.94	
	23.10 (grams)	2.35 (mg/g)	100.00		54.18	

Test No. 79

Conditions: 2% sodium carbonate
140 deg. C
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	50.00	350.40	20.90	20.90	17.52	1.00
	50.00	125.10	7.46	28.36	6.26	2.00
	100.00	32.60	3.89	32.25	3.26	4.00
	100.00	4.76	0.57	32.82	0.48	6.00
	100.00	3.49	0.42	33.23	0.35	8.00
	100.00	2.18	0.26	33.49	0.22	10.00
	100.00	2.04	0.24	33.74	0.20	12.00
	100.00	1.83	0.22	33.96	0.18	14.00
Wash 1	250.00	1.21	0.36	34.32	0.30	
Wash 2	250.00	1.01	0.30	34.62	0.25	
Carbon	34.69	1.58	65.38	100.00	54.81	
	34.69 (grams)	2.42 (mg/g)	100.00		83.83	

Test No. 80

Conditions: 120.9g/L (0.5 M/LO sodium sulphide
95 deg. C.
Two bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	48.00	695.90	65.00	65.00	33.40	2.00
	60.00	175.50	20.49	85.49	10.53	4.00
	40.00	78.70	6.13	91.62	3.15	6.00
	40.00	58.50	4.55	96.17	2.34	8.00
	40.00	9.88	0.77	96.94	0.40	10.00
	40.00	3.68	0.29	97.23	0.15	12.00
	40.00	2.66	0.21	97.44	0.11	14.00
	46.00	2.29	0.20	97.64	0.11	16.00
	40.00	2.09	0.16	97.80	0.08	18.00
	42.00	1.98	0.16	97.96	0.08	20.00
	40.00	2.14	0.17	98.13	0.09	22.00
	40.00	1.84	0.14	98.27	0.07	24.00
	40.00	1.62	0.13	98.40	0.06	26.00
	40.00	1.90	0.15	98.55	0.08	28.00
	40.00	1.40	0.11	98.66	0.06	30.00
	40.00	1.30	0.10	98.76	0.05	32.00
	40.00	1.20	0.09	98.85	0.05	34.00
	40.00	1.08	0.08	98.94	0.04	36.00
	40.00	1.02	0.08	99.02	0.04	38.00
	40.00	0.91	0.07	99.09	0.04	40.00
	40.00	0.78	0.06	99.15	0.03	42.00
Wash	150.00	0.23	0.07	99.21	0.03	
Carbon	6.73	0.06	0.79	100.00	0.40	
	6.73 (grams)	7.64 (mg/g)	100.00		51.39	

Test No. 81

Conditions: 2 g/L NaCN, 10 g/L NaOH
40 deg. C
2.5 bed volume per hour

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	52.00	130.70	8.91	8.91	6.80	2.00
	50.00	133.40	8.74	17.65	6.67	4.00
	60.00	210.30	16.54	34.19	12.62	6.00
	50.00	232.50	15.24	49.43	11.63	8.00
	50.00	252.30	16.53	65.96	12.62	10.00
	50.00	229.50	15.04	81.00	11.48	12.00
	50.00	101.30	6.64	87.64	5.06	14.00
	50.00	55.68	3.65	91.29	2.78	16.00
	50.00	35.89	2.35	93.64	1.79	18.00
Wash 1	100.00	9.63	1.26	94.90	0.96	
Wash 2	100.00	2.39	0.31	95.22	0.24	
Wash 3	100.00	1.75	0.23	95.45	0.18	
Wash 4	250.00	0.80	0.26	95.71	0.20	
Wash 5	250.00	0.14	0.05	95.76	0.04	
Carbon	19.05	0.17	4.24	100.00	3.24	
	19.05 (grams)	4.00 (mg/g)	100.00		76.29	

Test No. 82

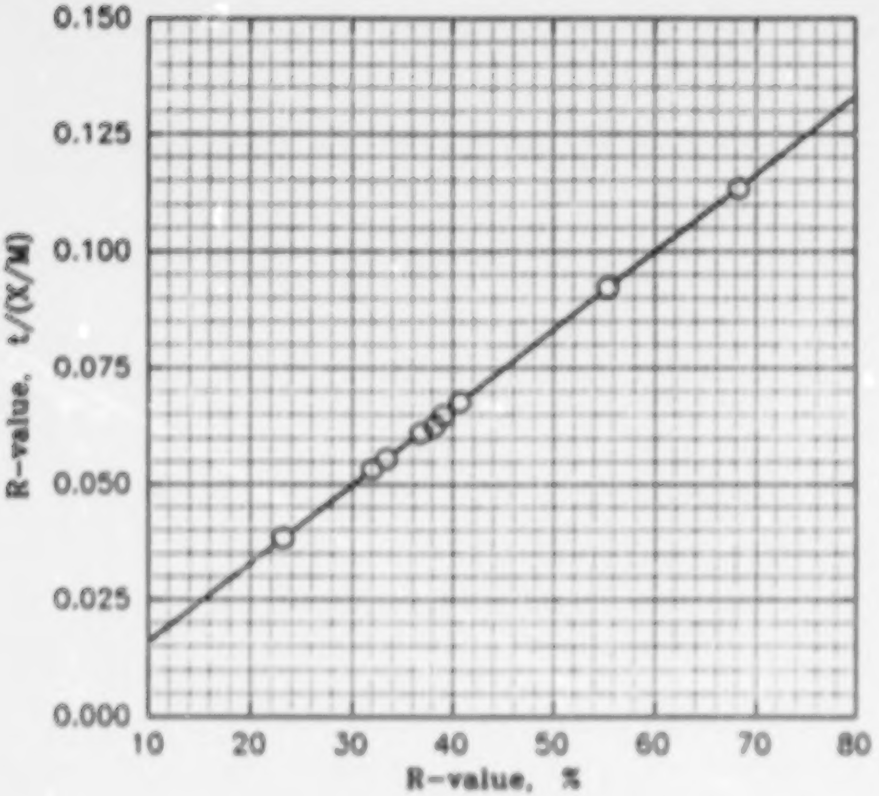
Conditions: Pre-wash with 5% nitric acid at 90 deg. C for one hour, then wash with 2% NaOH for 1 hour. Elution with 2% sodium cabonate at 140 deg. C and two bed volume per hour.

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	100.00	383.40	37.46	37.46	38.34	2.00
	100.00	228.50	22.33	59.78	22.85	4.00
	100.00	40.53	3.96	63.74	4.05	6.00
	101.00	13.57	1.34	65.08	1.37	8.00
	100.00	3.51	0.34	65.43	0.35	10.00
	100.00	3.65	0.36	65.78	0.37	12.00
	100.00	3.39	0.33	66.11	0.34	14.00
	100.00	3.21	0.31	66.43	0.32	16.00
	100.00	0.66	0.06	66.49	0.07	18.00
Wash	200.00	0.57	0.11	66.60	0.11	
Wash	250.00	0.10	0.02	66.63	0.03	
Carbon	25.49	1.34	33.37	100.00	34.16	
	25.49 (grams)	4.02 (mg/g)	100.00		102.35	

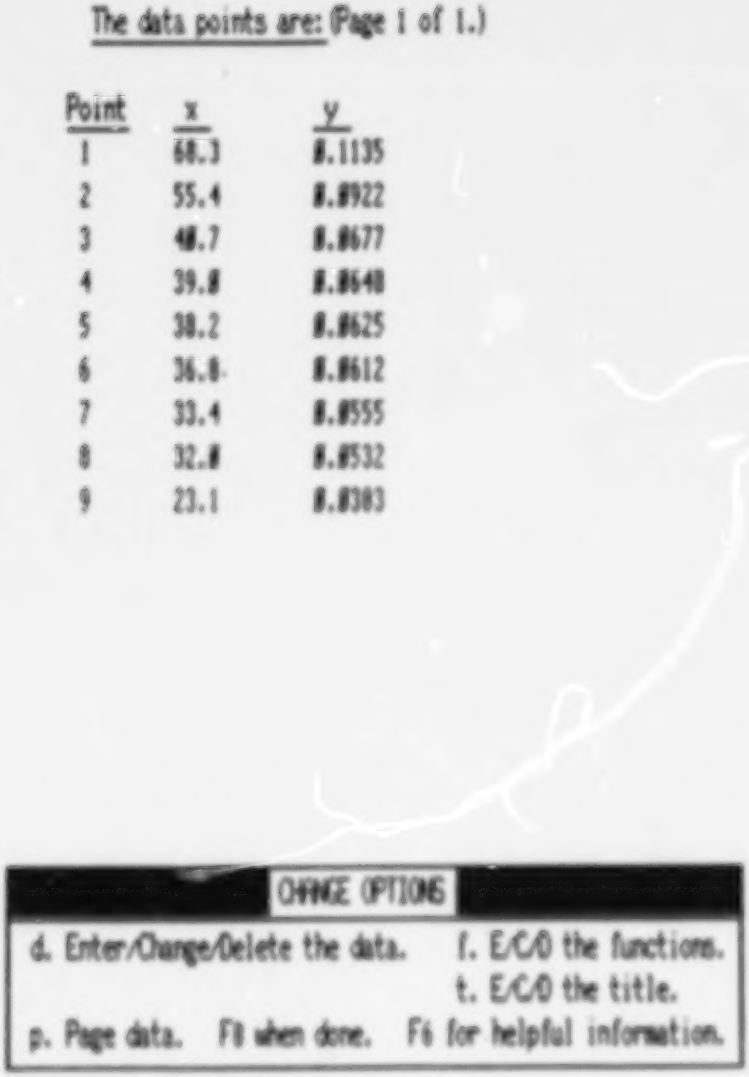
Test No. 83

Conditions: Elution solution contained 3% thiourea
1% NaOH and 0.05% NaCN
Two bed volume per hour
95 deg. C

	Volume	Assay	% Distribution		Metal	B.V.
	ml	Au, mg/L	Ind.	Cum.	Unit	cum.
	50.00	3.40	0.32	0.32	0.17	2.00
	40.00	487.30	36.31	36.63	19.49	4.00
	40.00	346.50	25.82	62.45	13.86	6.00
	40.00	217.60	16.22	78.67	8.70	8.00
	40.00	110.30	8.22	86.89	4.41	10.00
	40.00	62.17	4.63	91.52	2.49	12.00
	40.00	37.58	2.80	94.32	1.50	14.00
	40.00	18.47	1.38	95.70	0.74	16.00
	40.00	7.36	0.55	96.25	0.29	18.00
	40.00	4.20	0.31	96.56	0.17	20.00
Wash	150.00	1.48	0.41	96.97	0.22	
Wash	200.00	0.28	0.10	97.08	0.06	
Carbon	9.23	0.17	2.92	100.00	1.57	
	9.23 (grams)	5.82 (mg/g)	100.00		53.68	



Relationship R-value in % and R-value in t/(X/M)



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The data points are: (Page 1 of 1.)

Point      x          y
  1      60.3      0.1135
  2      55.4      0.0922
  3      40.7      0.0677
  4      39.0      0.0640
  5      38.2      0.0625
  6      36.0      0.0612
  7      33.4      0.0555
  8      32.0      0.0532
  9      23.1      0.0303

                    CHANGE OPTIONS
d. Enter/Change/Delete the data.     f. E/C/D the functions.
                                     t. E/C/D the title.
p. Page data.   F10 when done.   F6 for helpful information.
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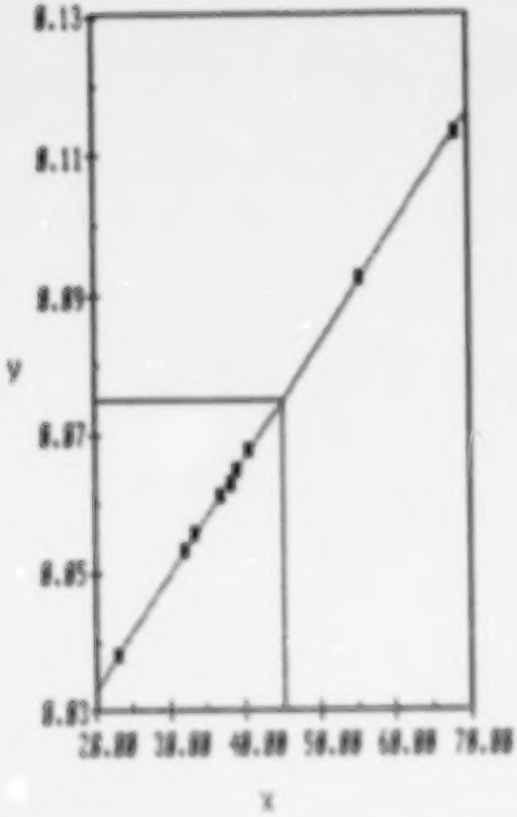

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y= 7.50*10^-2        x= 45.176


Press any key for options.
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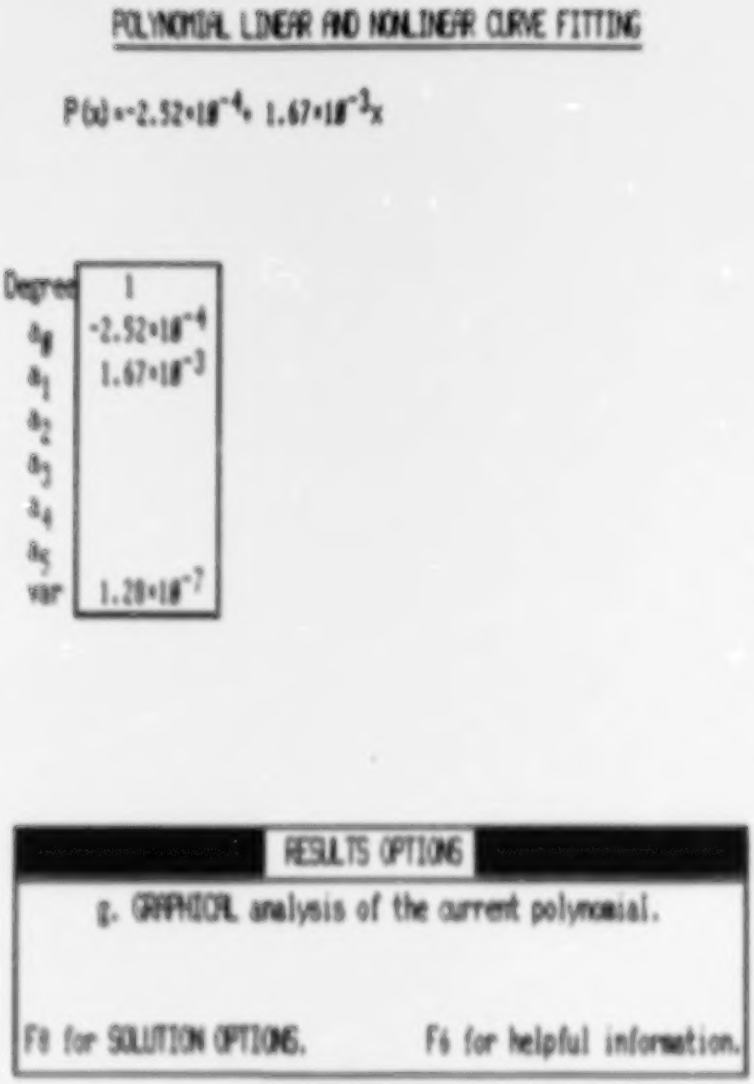


POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = -2.52 * 10^{-4} + 1.67 * 10^{-3} x$

Degree	1
a_0	$-2.52 * 10^{-4}$
a_1	$1.67 * 10^{-3}$
a_2	
a_3	
a_4	
a_5	
var	$1.20 * 10^{-7}$

RESULTS OPTIONS

g. GRAPHICAL analysis of the current polynomial.

F0 for SOLUTION OPTIONS.

F6 for helpful information.

Test No. 84

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.65

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

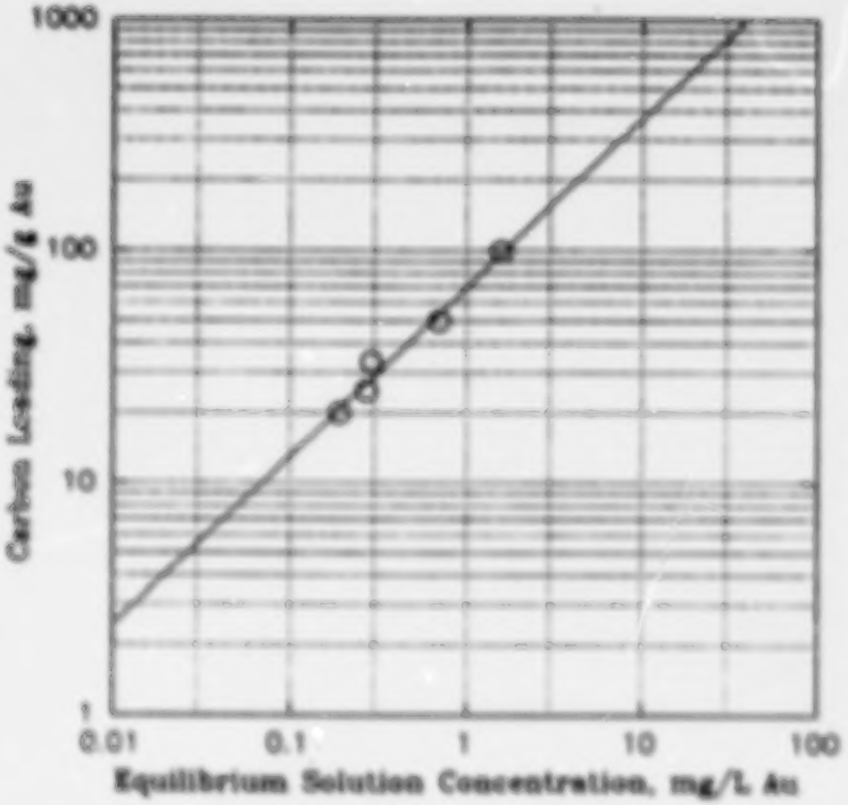
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

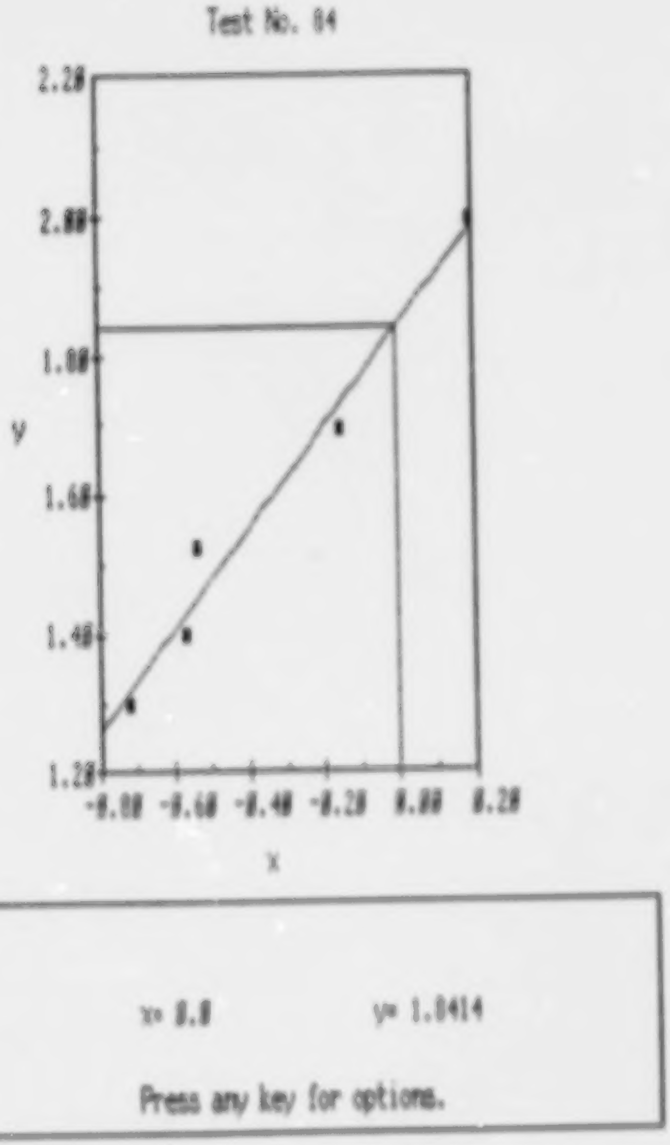
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	1.56	98.44
0.40	100.00	0.70	49.65
0.60	100.00	0.29	33.24
0.80	100.00	0.27	24.93
1.00	100.00	0.19	19.96

From graph: K-value = 69.4 mg/g



K-Value Calculation for Test No. 84


Test No. 84
2.20
2.00
1.80
1.60
1.40
1.20
Y
-0.80
-0.60
-0.40
-0.20
0.00
0.20
X

```
x= 0.0                y= 1.8414

Press any key for options.
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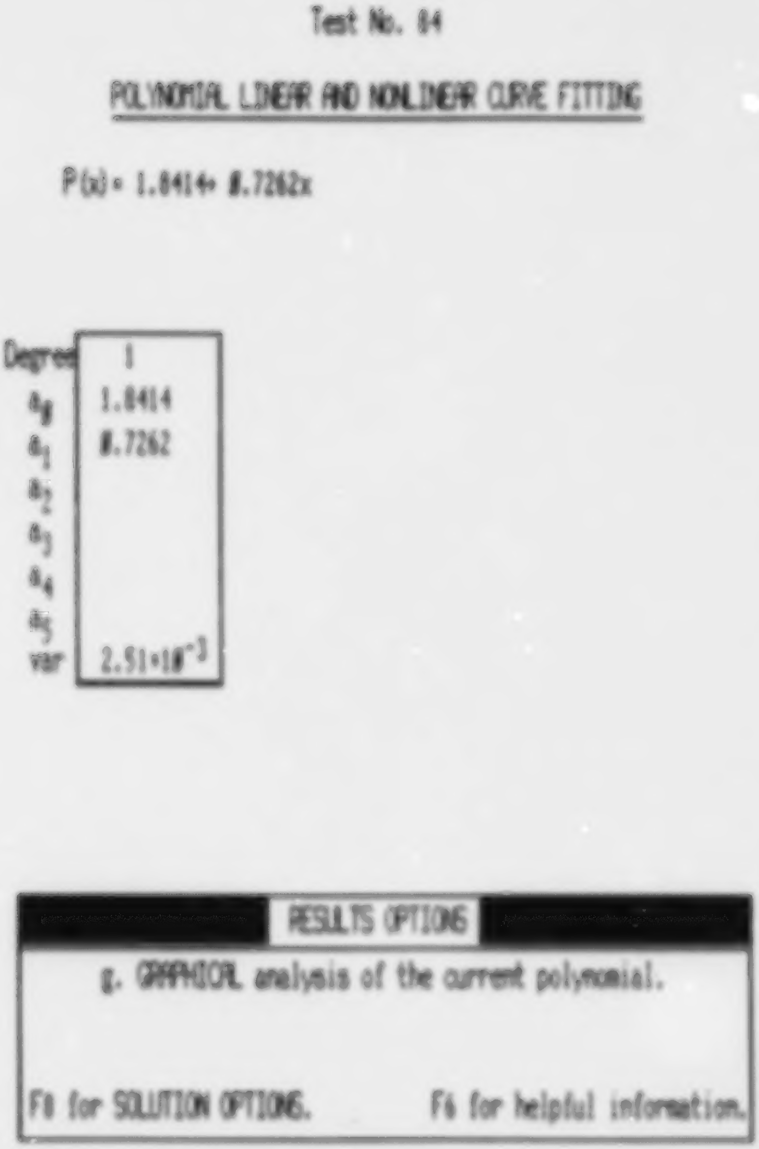


Test No. 04

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.0414 + 0.7262x$

Degree	1
a_0	1.0414
a_1	0.7262
a_2	
a_3	
a_4	
a_5	
var	2.51×10^{-3}

RESULTS OPTIONS

g. GRAPHICAL analysis of the current polynomial.

F0 for SOLUTION OPTIONS. F6 for helpful information.

Test No. 85

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.45.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.81	8.91	7.88	6.72	6.06	5.29	4.73

$$R \text{ value } (\%) = 100*(9.81 - 6.06)/9.81$$
$$= 38.2$$

Test No. 86

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated NaCN-NaOH solution (Test No. 83).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.70

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

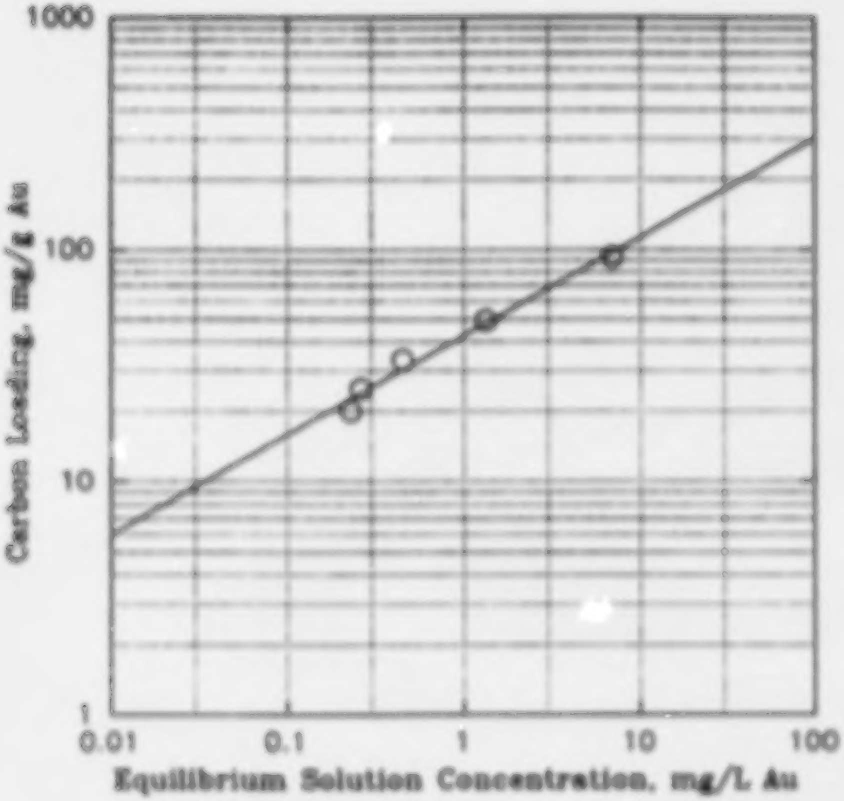
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

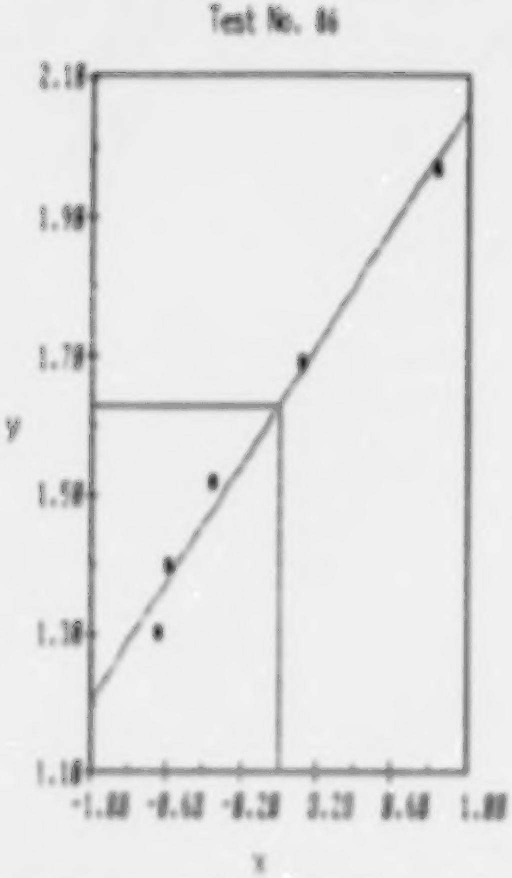
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.88	93.12
0.40	100.00	1.32	49.34
0.60	100.00	0.45	33.18
0.80	100.00	0.26	24.94
1.00	100.00	0.23	19.95

From graph: K-value = 42.5 mg/g



K-Value Calculation for Test No. 86



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x= 0.0                y= 1.6201

      Press any key for options.
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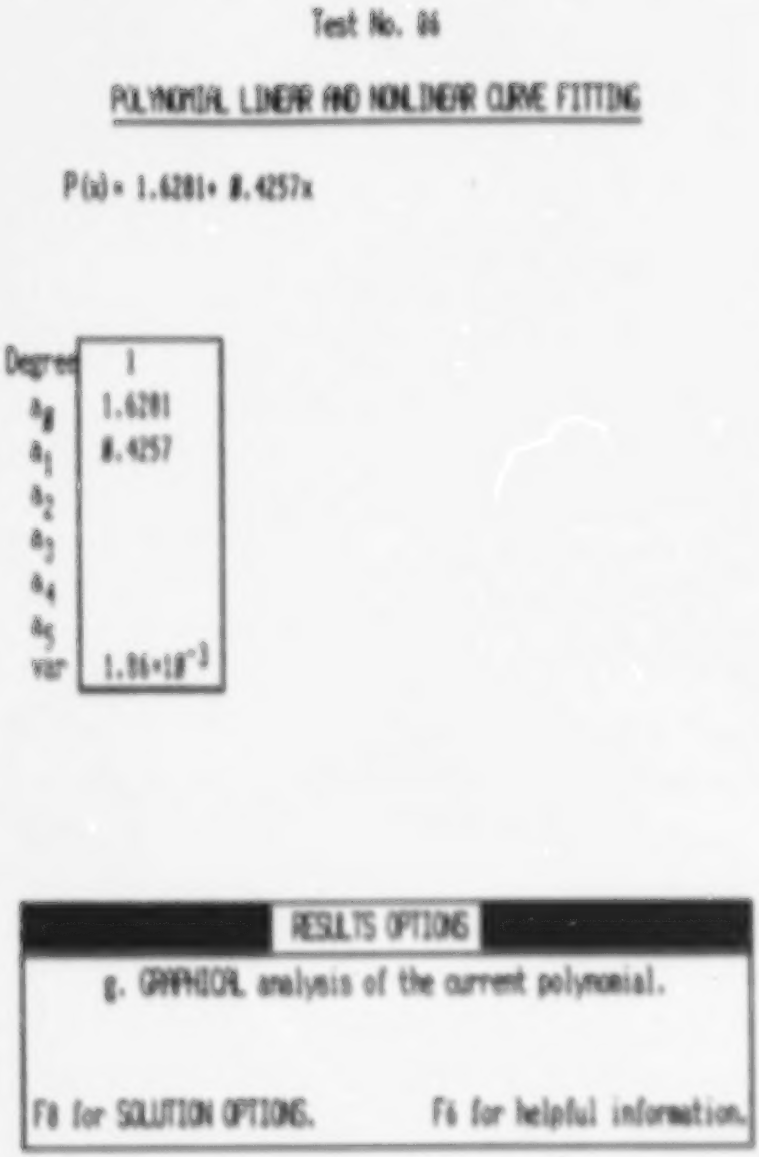


Test No. 86

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.6201 + 0.4257x$

Degree	1
a_0	1.6201
a_1	0.4257
a_2	
a_3	
a_4	
a_5	
var	$1.86 \cdot 10^{-3}$

RESULTS OPTIONS

g. GRAPHICAL analysis of the current polynomial.

F8 for SOLUTION OPTIONS.

F6 for helpful information.

Test No. 87

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of NaCN-NaOH solution (Test No. 83).

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.60.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.97	4.58	4.22	3.63	3.16	2.88	2.60

$$\begin{aligned} R \text{ value } (\%) &= 100*(9.97 - 3.16)/9.97 \\ &= 68.3 \end{aligned}$$

Test No. 88

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold cyanide solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated NaCN-NaOH solution (Test No. 81).

Solution: Gold cyanide solution contained 200 mg/L Au. pH = 11.65.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.4000, 0.8000, 1.2000, 1.6000, and 2.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold cyanide solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

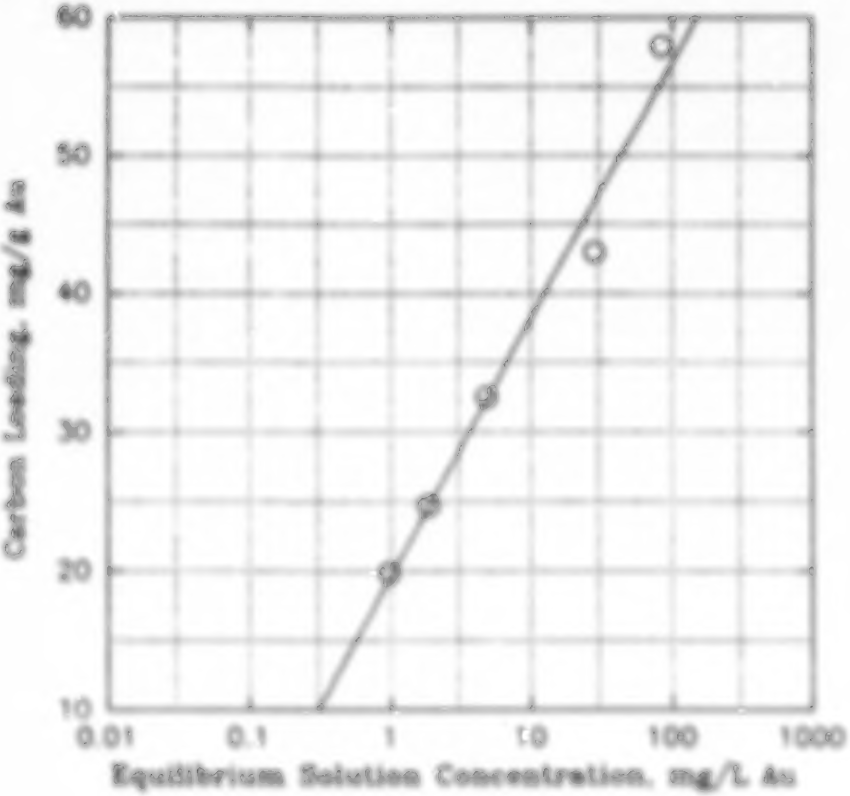
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

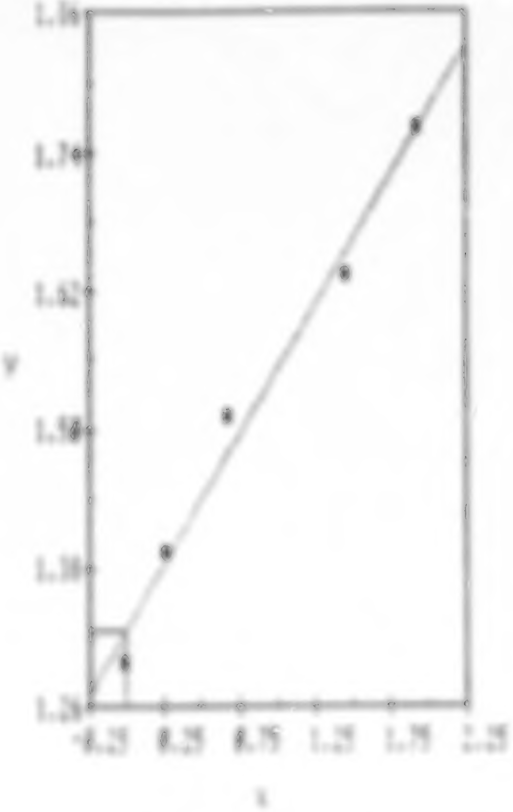
Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.40	200.00	84.14	57.93
0.80	200.00	28.29	42.93
1.20	200.00	4.76	32.54
1.60	200.00	1.82	24.77
2.00	200.00	0.97	19.90

From graph: K-value = 21.2 mg/g



K-Value Calculation for Test No. 88

Test No. 08



x= 0.0 y= 1.3261

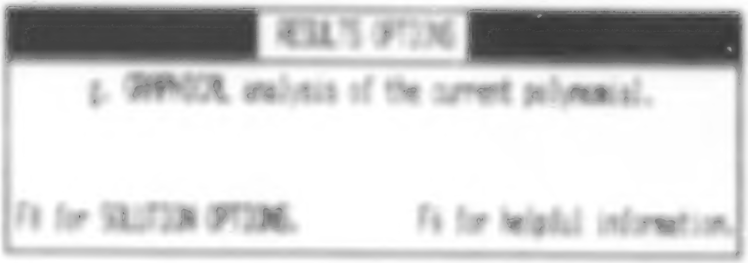
Press any key for options.

Test No. 08

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.3261 + 0.2256x$

Degree	1
a_0	1.3261
a_1	0.2256
a_2	
a_3	
a_4	
a_5	
var	7.44×10^{-6}



g. GRAPHICAL analysis of the current polynomial.

F1 for SOLUTION OPTIONS. F5 for helpful information.

Test No. 89

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of sodium sulphide solution (Test No. 80).

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.45.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.99	8.11	7.52	7.13	6.52	5.63	4.62

$$\begin{aligned}\text{R value (\%)} &= 100*(9.99 - 6.52)/9.99 \\ &= 34.7\end{aligned}$$

Test No. 90

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated sodium sulphide solution (Test No. 80).

Solution: Gold thiourea solution contained 200 mg/L Au.
pH = 2.55.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.4000, 0.8000, 1.2000, 1.6000, and 2.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

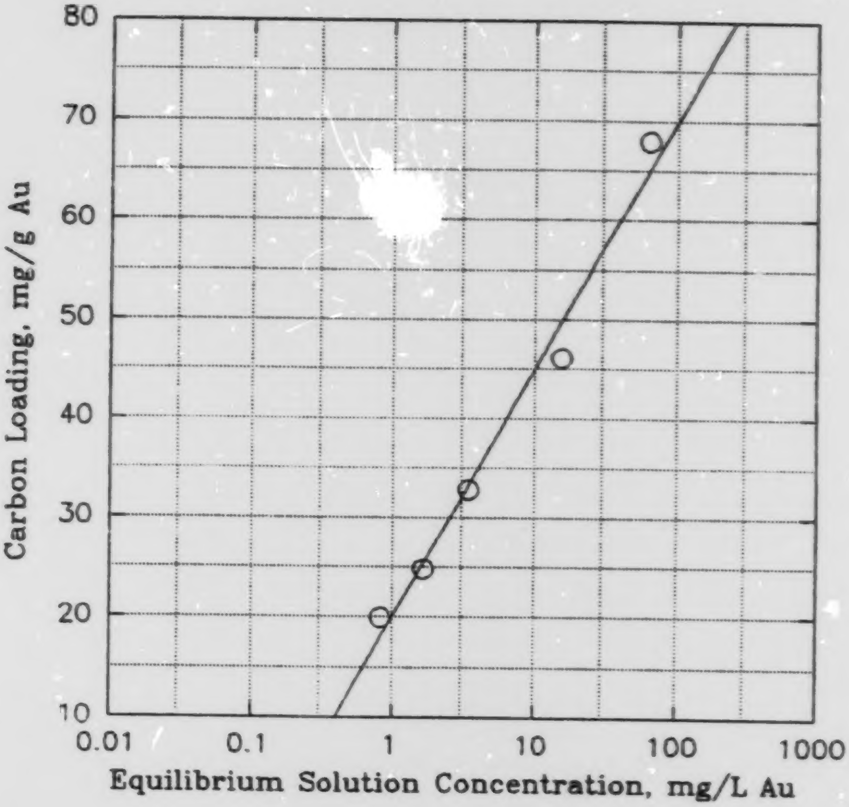
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

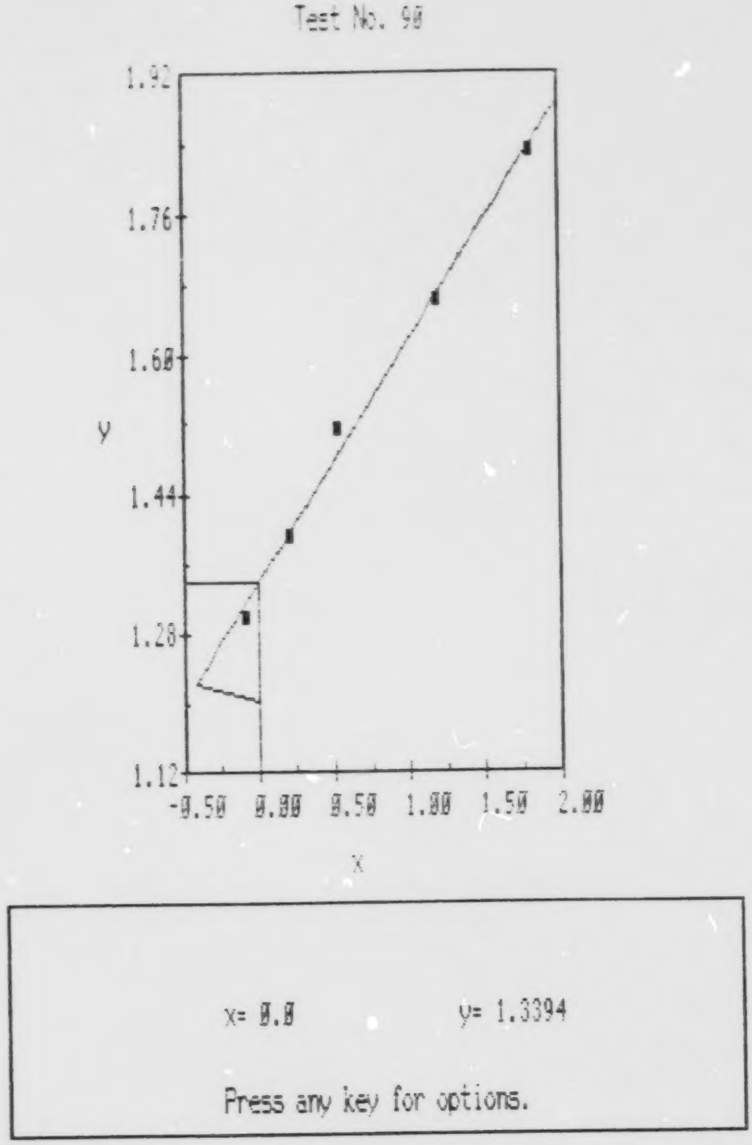
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.40	200.00	64.23	67.89
0.80	200.00	15.68	46.08
1.20	200.00	3.36	32.77
1.60	200.00	1.63	24.80
2.00	200.00	0.82	19.92

From graph: K-value = 21.8 mg/g

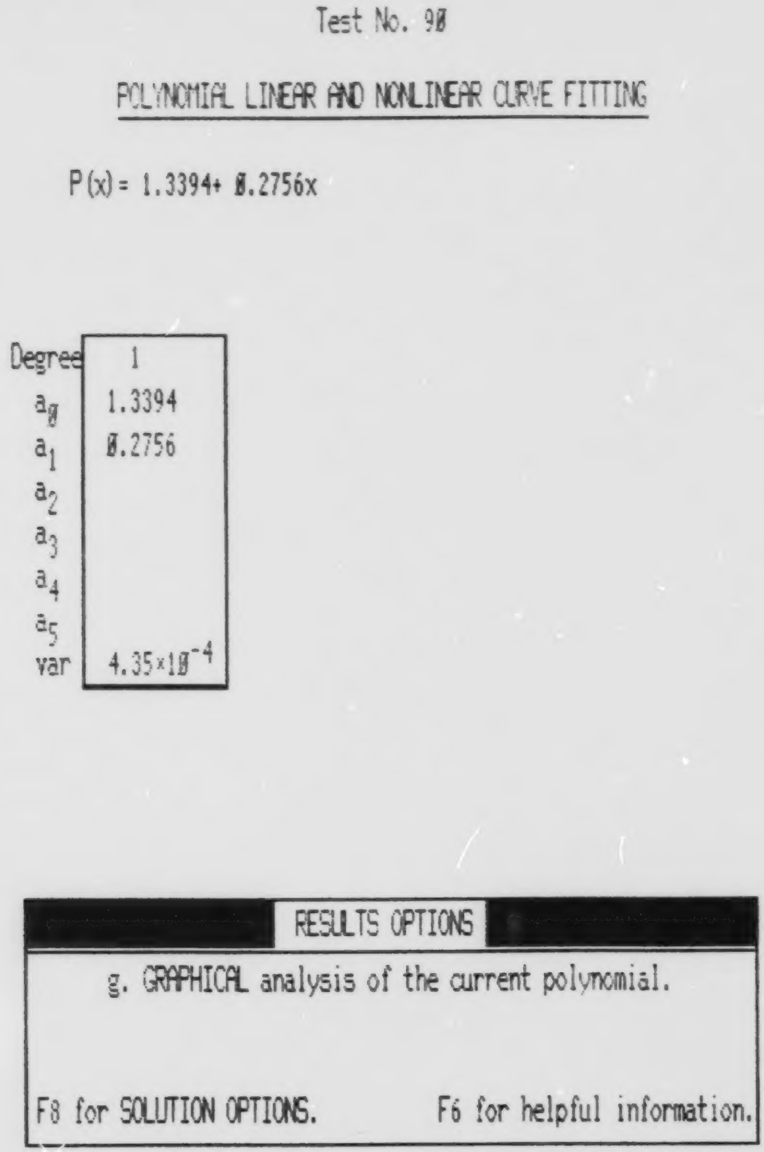


K–Value Calculation for Test No. 90


Test No. 90
1.92
1.76
1.60
1.44
1.28
1.12
Y
-0.50
0.00
0.50
1.00
1.50
2.00
X

```
x= 0.0          y= 1.3394

Press any key for options.
```



Test No. 90

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.3394 + 0.2756x$

Degree	1
a_0	1.3394
a_1	0.2756
a_2	
a_3	
a_4	
a_5	
var	4.35×10^{-4}

```
                 RESULTS OPTIONS
   g. GRAPHICAL analysis of the current polynomial.


F8 for SOLUTION OPTIONS.      F6 for helpful information.
```

Test No. 91

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of butanol thiourea solution (Test No. 76).

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.50.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.98				6.79		

$$\begin{aligned}\text{R value (\%)} &= 100*(9.98 - 6.79)/9.98 \\ &= 32.0\end{aligned}$$

Test No. 92

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated butanol thiourea solution (Test No. 76).

Solution: Gold thiourea solution contained 200 mg/L Au.
pH = 1.70.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.4000, 0.8000, 1.2000, 1.6000, and 2.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

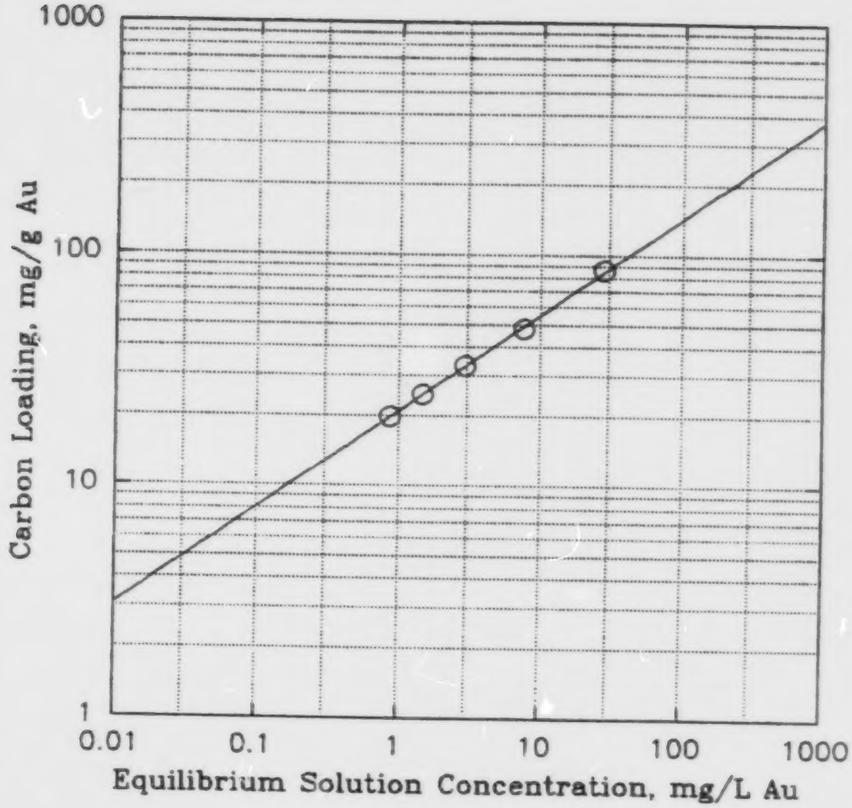
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

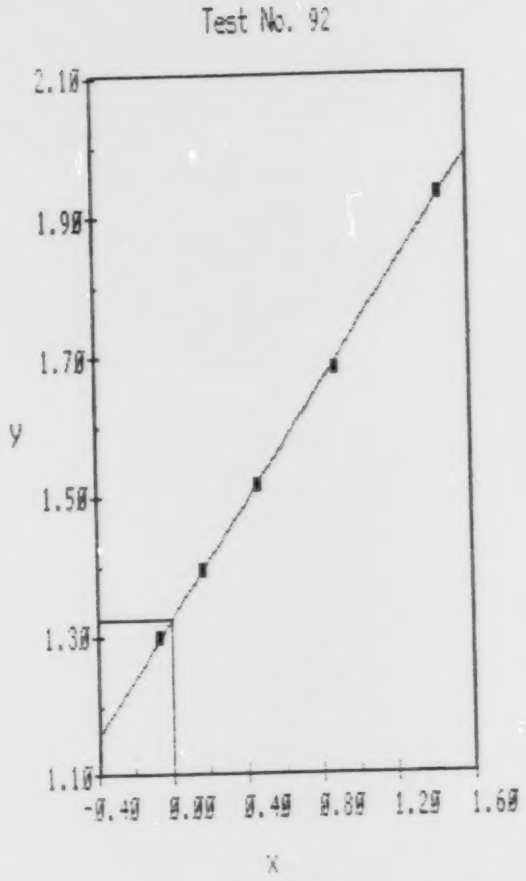
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.40	200.00	27.94	86.03
0.80	200.00	7.67	48.08
1.20	200.00	2.93	32.85
1.60	200.00	1.46	24.82
2.00	200.00	0.86	19.91

From graph: K-value = 21.1 mg/g



K–Value Calculation for Test No. 92



```
x= 0.0          y= 1.3234

Press any key for options.
```

Test No. 92

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.3234 + 0.4176x$

Degree	1
a_0	1.3234
a_1	0.4176
a_2	
a_3	
a_4	
a_5	
var	6.40×10^{-5}

RESULTS OPTIONS

g. GRAPHICAL analysis of the current polynomial.

F8 for SOLUTION OPTIONS. F6 for helpful information.

Test No. 93

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of butanol thiourea solution (Test No. 69).

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.50.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.98				6.65		

R value (%) = 100*(9.98 - 6.65)/9.98
= 33.4

Test No. 94

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated butanol thiourea solution (Test No. 69).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.70.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

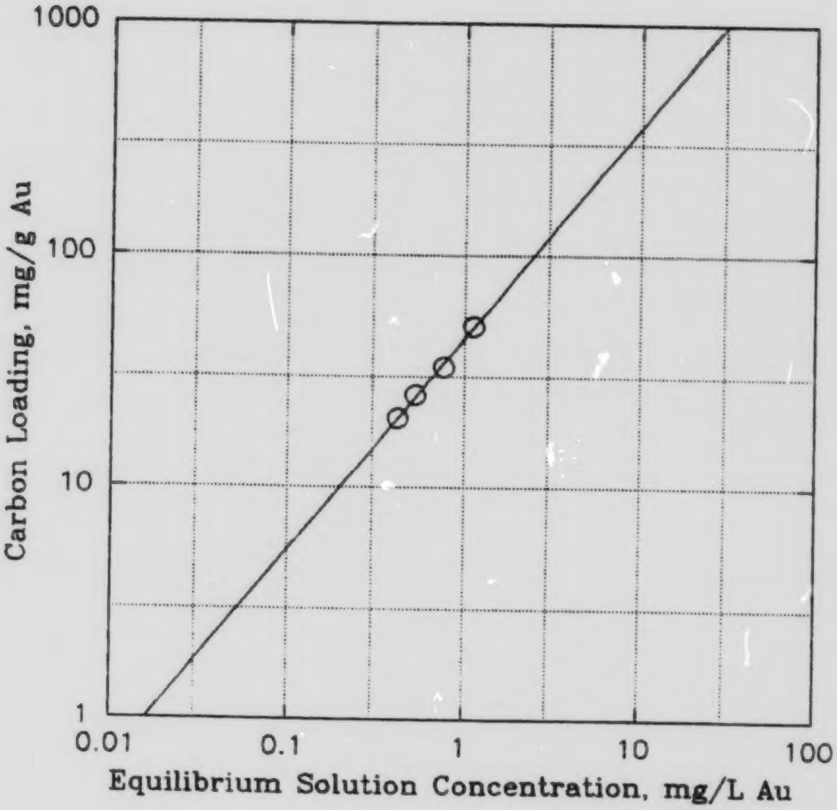
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

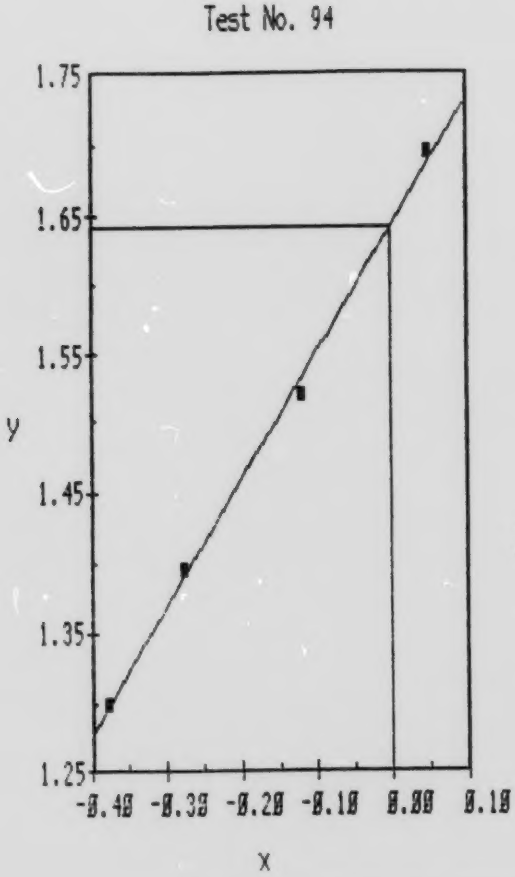
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	15.30	84.70
0.40	100.00	1.12	49.44
0.60	100.00	0.76	33.08
0.80	100.00	0.53	24.87
1.00	100.00	0.42	19.92

From graph: K-value = 43.9 mg/g



K–Value Calculation for Test No. 94



```
x= 0.0              y= 1.6421

Press any key for options.
```

```
                    Test No. 94

     POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

  P(x)= 1.6421+ 0.9123x

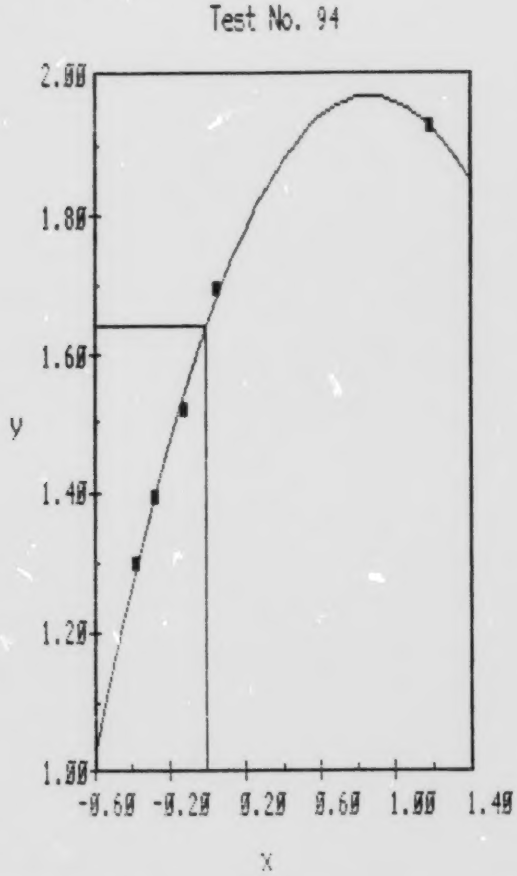


Degree    1
 a_0   1.6421
 a_1   0.9123
 a_2
 a_3
 a_4
 a_5
 var   1.34×10^-4



 ---------------- RESULTS OPTIONS ----------------
      g. GRAPHICAL analysis of the current polynomial.

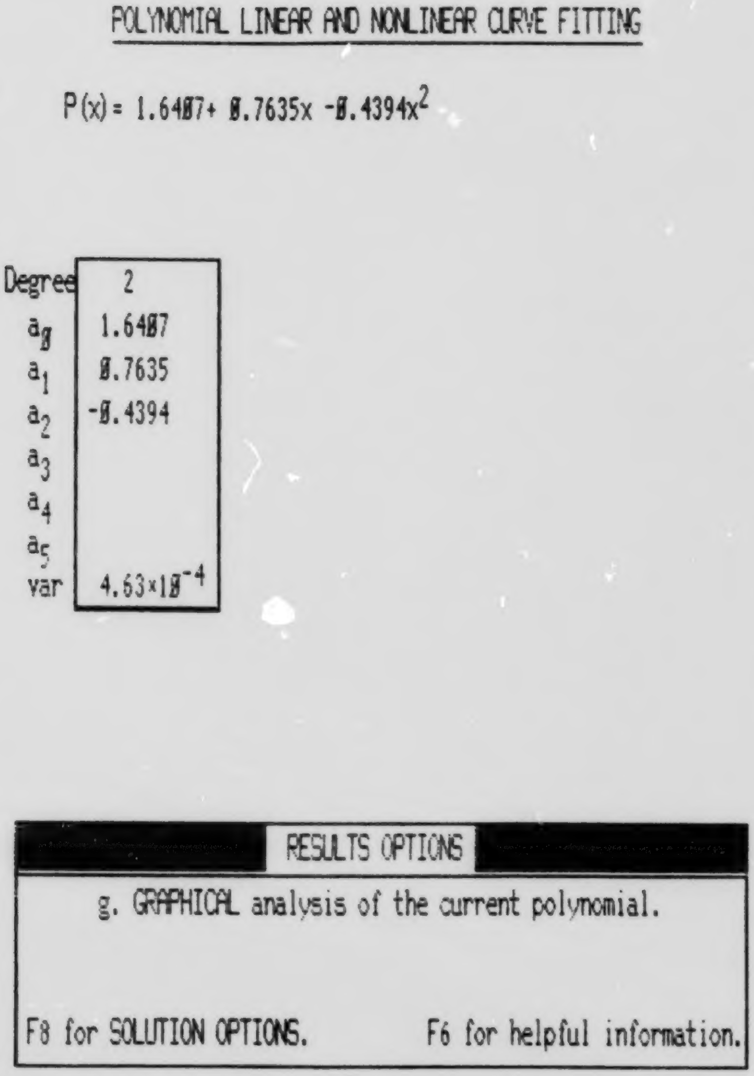

 F8 for SOLUTION OPTIONS.       F6 for helpful information.
```



```
x= 0.0          y= 1.6407

Press any key for options.
```

Test No. 94



```
POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

P(x)= 1.6407+ 0.7635x -0.4394x^2


Degree   2
a0       1.6407
a1       0.7635
a2       -0.4394
a3
a4
a5
var      4.63x10^-4


                     RESULTS OPTIONS
     g. GRAPHICAL analysis of the current polynomial.


F8 for SOLUTION OPTIONS.        F6 for helpful information.
```

Test No. 95

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of sodium sulphide solution (Test No. 26).

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.50.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^{0} C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.98				5.92		

R value (%) = 100*(9.98 - 5.92)/9.98
= 40.7

Test No. 96

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated sodium sulphide solution (Test No. 26).

Solution: Gold thiourea solution contained 100 mg/L Au. pH = 1.75.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

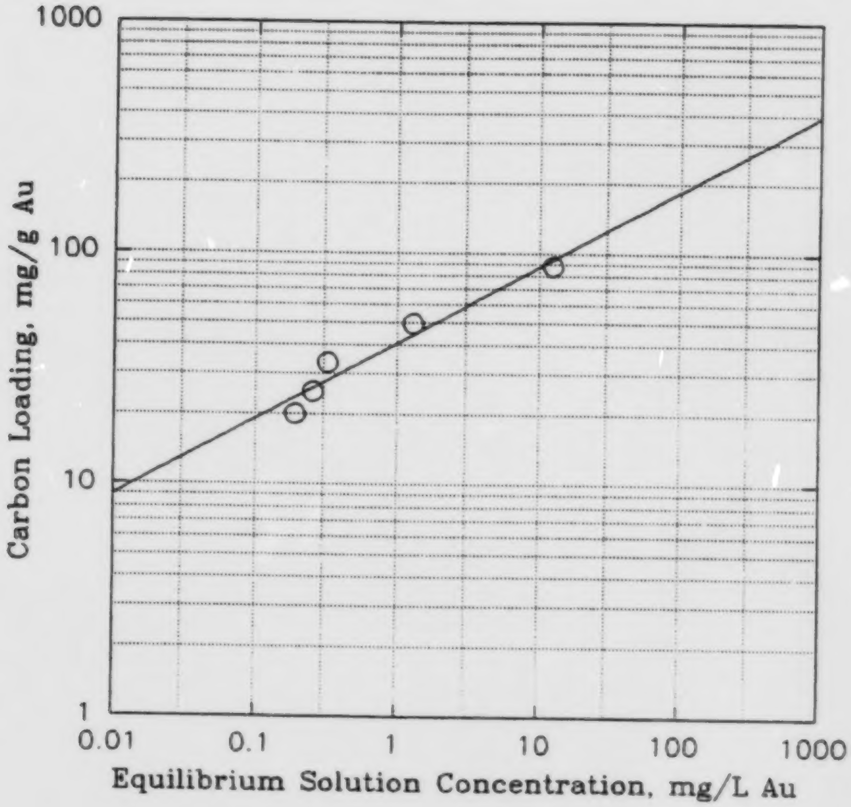
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

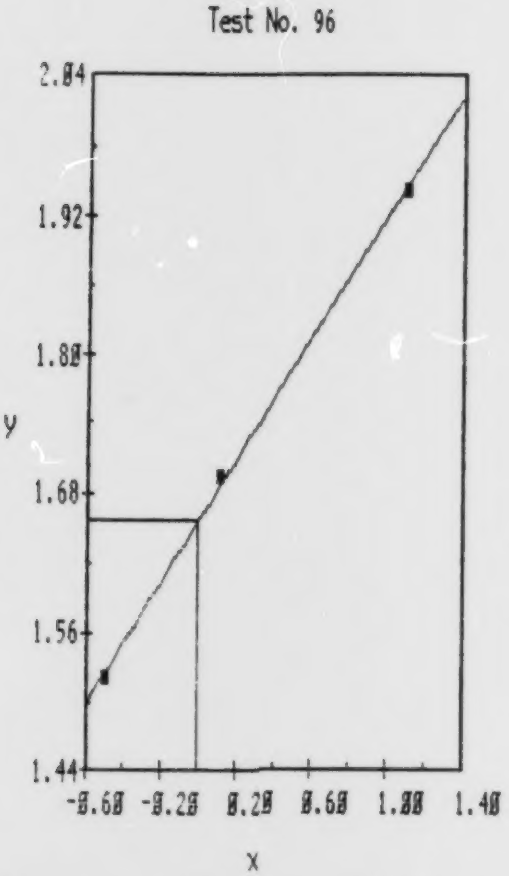
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	12.47	87.53
0.40	100.00	1.30	49.35
0.60	100.00	0.32	33.23
0.80	100.00	0.25	24.94
1.00	100.00	0.19	19.96

From graph: K-value = 45.3 mg/g



K–Value Calculation for Test No. 96

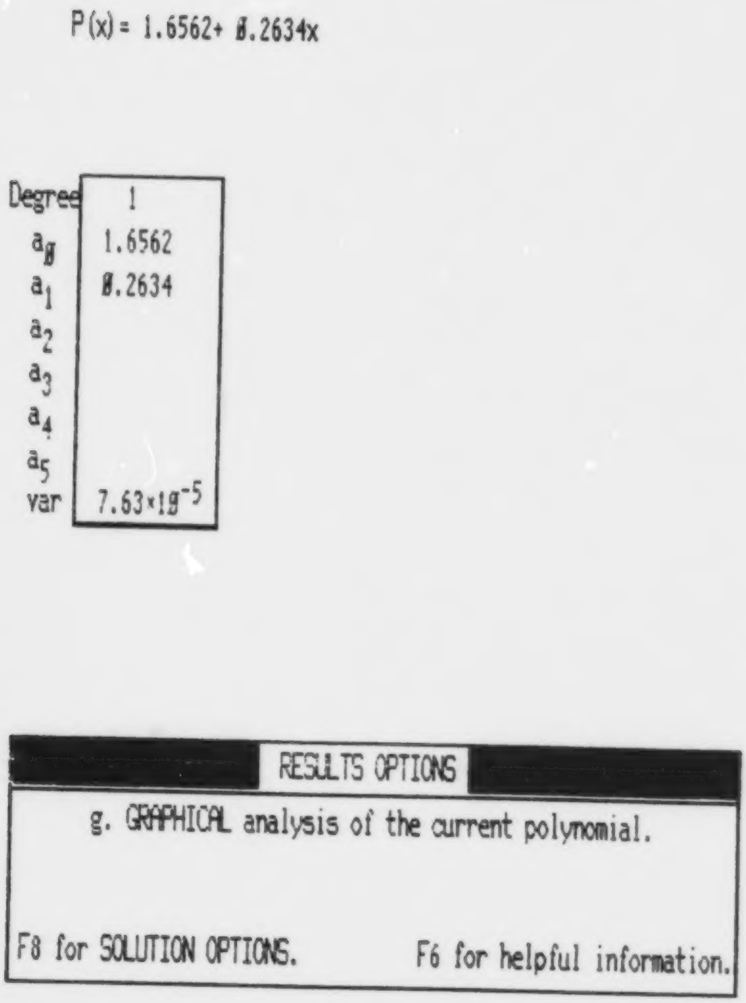


```
x= 0.0          y= 1.6562

Press any key for options.
```

Test No. 96

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

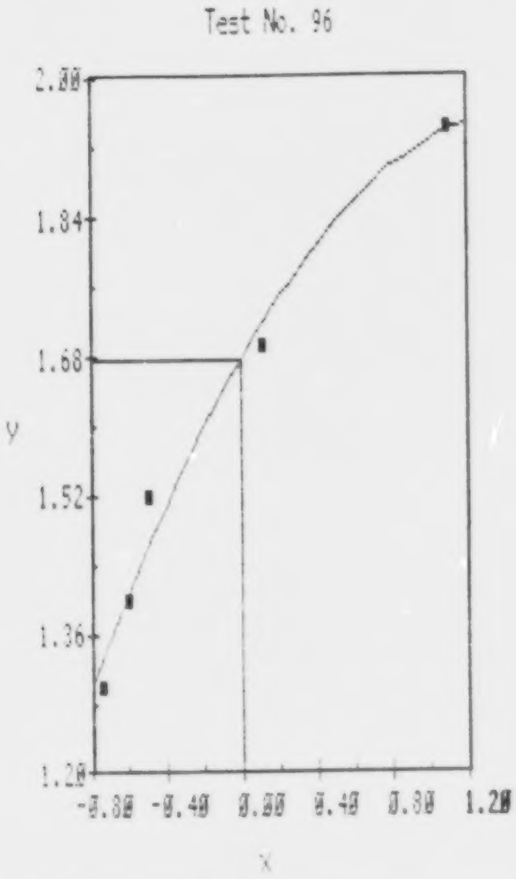


```
P(x)= 1.6562+ 0.2634x


Degree |    1        |
  a0   | 1.6562      |
  a1   | 0.2634      |
  a2   |             |
  a3   |             |
  a4   |             |
  a5   |             |
  var  | 7.63×10^-5  |

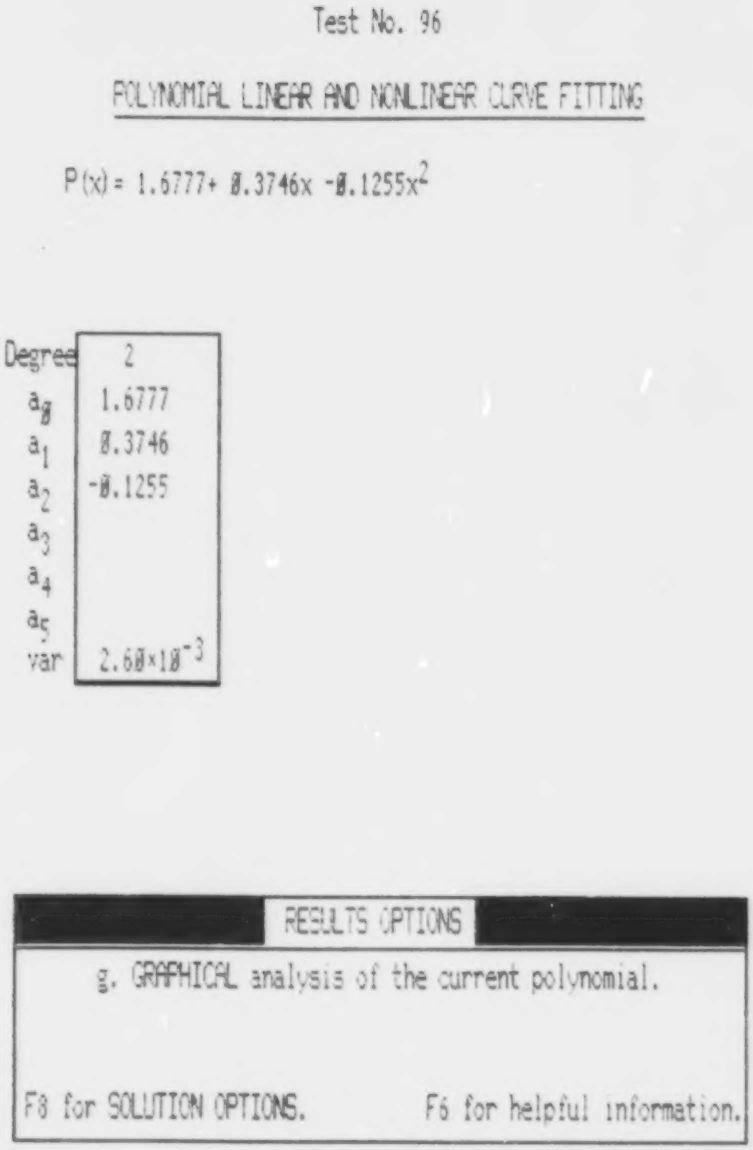

              RESULTS OPTIONS
   g. GRAPHICAL analysis of the current polynomial.

F8 for SOLUTION OPTIONS.        F6 for helpful information.
```



```
x= 0.0              y= 1.6777

Press any key for options.
```



```
                    Test No. 96

     POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

P(x)= 1.6777+ 0.3746x -0.1255x^2



Degree |    2        |
  a0   |  1.6777     |
  a1   |  0.3746     |
  a2   | -0.1255     |
  a3   |             |
  a4   |             |
  a5   |             |
  var  | 2.60×10^-3  |



 ----------------- RESULTS OPTIONS -----------------
|    g. GRAPHICAL analysis of the current polynomial. |
|                                                     |
|F8 for SOLUTION OPTIONS.      F6 for helpful information.|
 -----------------------------------------------------
```

Test No. 97

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of sodium sulphide solution (Test No. 27).

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 2.50.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.98				4.45		

$$R \text{ value } (\%) = 100*(9.98 - 4.45)/9.98$$
$$= 55.4$$

Test No. 98

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated sodium sulphide solution (Test No. 27).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.70.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

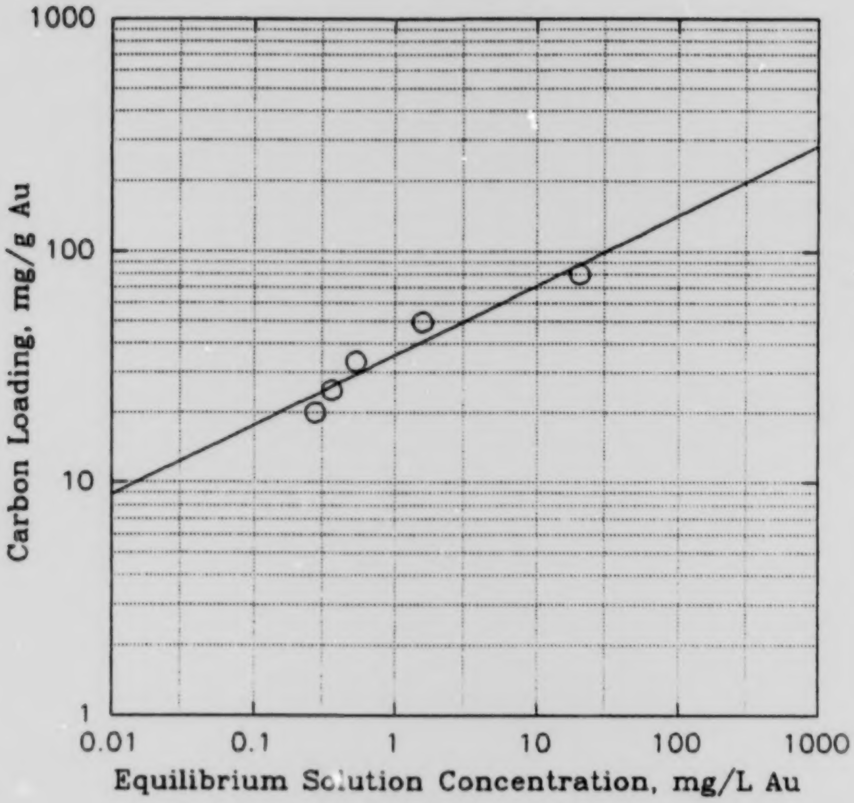
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

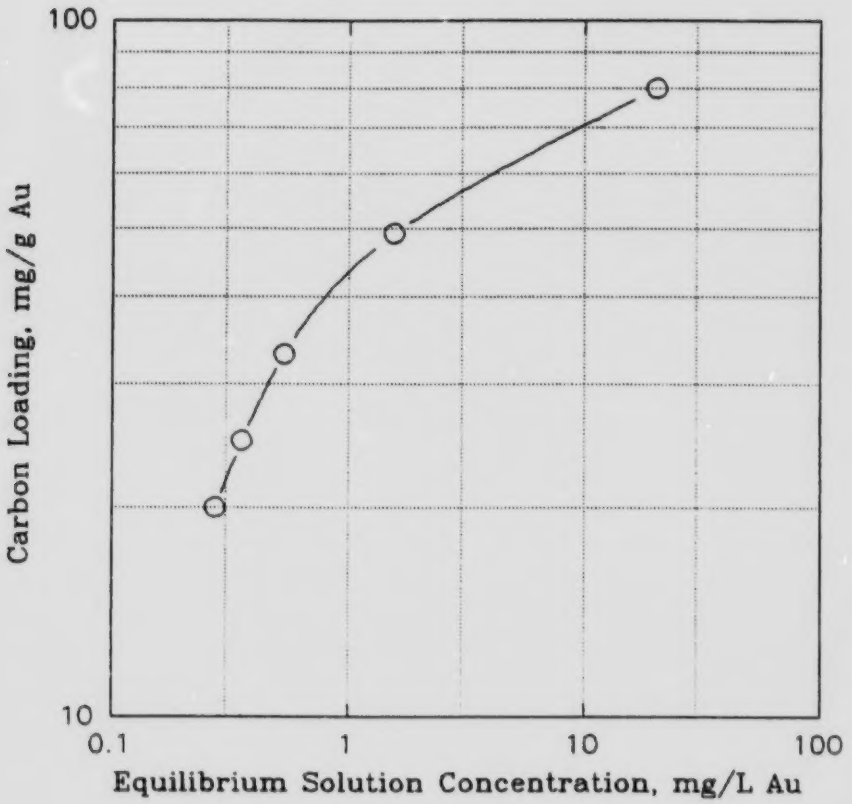
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	20.20	79.80
0.40	100.00	1.56	49.22
0.60	100.00	0.53	33.16
0.80	100.00	0.35	24.91
1.00	100.00	0.27	19.95

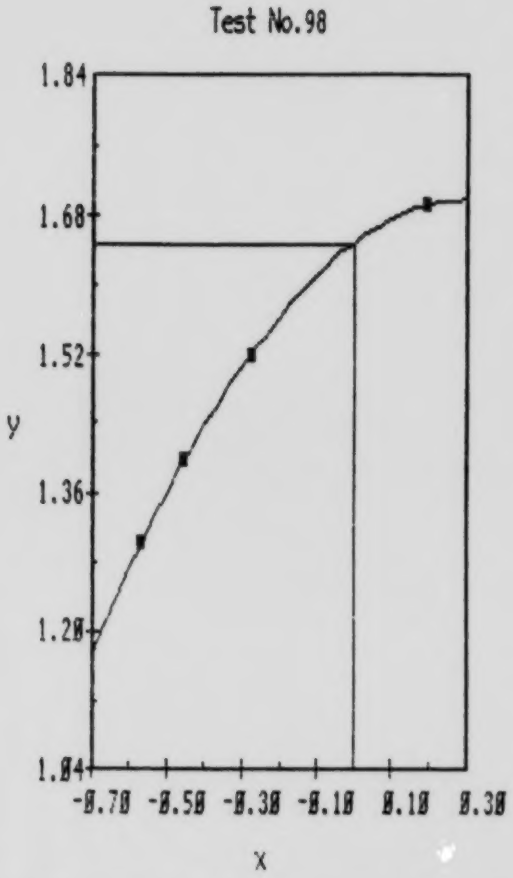
From graph: K-value = 44.5 mg/g



K–Value Calculation for Test No. 98



K-Value Calculation for Test No. 98



```
x= 0.0          y= 1.6487

Press any key for options.
```

Test No.98

```
POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

P(x)= 1.6487+ 0.3228x -0.5098x^2

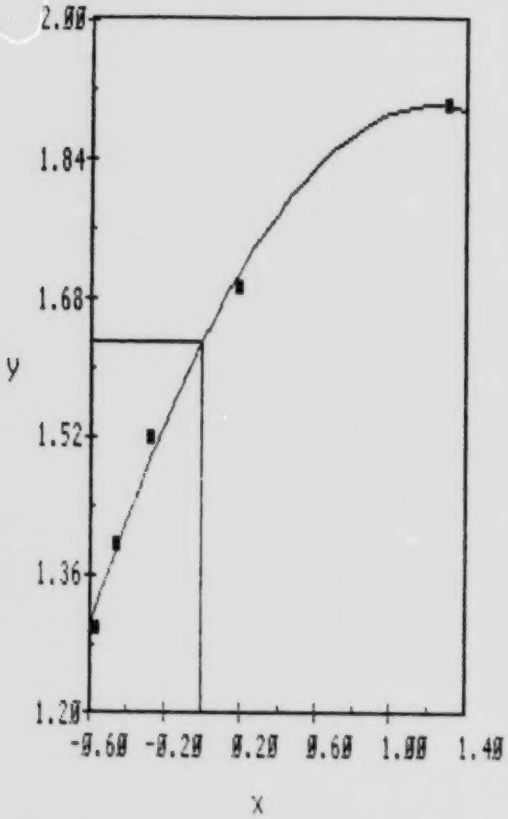

Degree     1          2
 a0     1.6142     1.6487
 a1     0.4947     0.3228
 a2               -0.5098
 a3
 a4
 a5
 var    1.64×10^-3  9.10×10^-7


                RESULTS OPTIONS
    g. GRAPHICAL analysis of the current polynomial.

   Use → or ← to select a different degree polynomial.

 F8 for SOLUTION OPTIONS.        F6 for helpful information.
```

Test No.98



```
x= 0.0            y= 1.6296

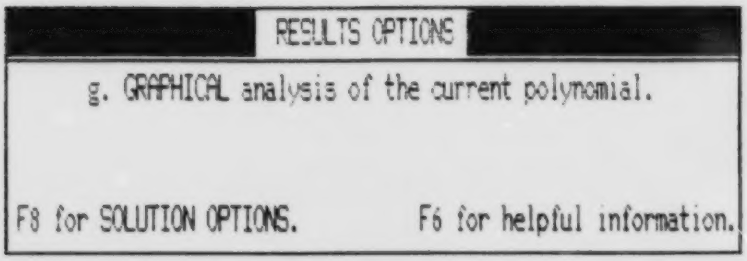
Press any key for options.
```

Test No.98

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.6296 + 0.4432x - 0.1809x^2$

Degree	2
a_0	1.6296
a_1	0.4432
a_2	-0.1809
a_3	
a_4	
a_5	
var	7.16×10^{-4}



RESULTS OPTIONS

g. GRAPHICAL analysis of the current polynomial.

F8 for SOLUTION OPTIONS.   F6 for helpful information.

Test No. 99

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold cyanide solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentration of NaCN-NaOH solution (Test No. 81).

Solution: Gold cyanide solution contained 10 mg/L Au.
pH = 11.8.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold cyanide solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.98				7.68		

R value (%) = 100*(9.98 - 7.68)/9.98
= 23.1

Test No. 101

Purpose: To repeat the R-value (gold adsorption rate) determination of a carbon sample adsorbed from a gold thiourea solution (repeat Test No. 89).

Sample: Test No. 80 carbon sample eluted with Na_2S.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	6.21

$$\text{R value (\%)} = 100*(9.99 - 6.21)/9.99$$
$$= 37.9$$

Test No. 102

Purpose: To repeat the R-value (gold adsorption rate) determination of a carbon sample adsorbed from a gold thiourea solution (repeat Test No. 91).

Sample: Test No. 76 carbon sample eluted with butanol thiourea.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.47

R value (%) = 100*(9.98 - 6.47)/9.98
= 35.3

Test No. 103

Purpose: To determine the K-value (loading capacity) of a carbon sample adsorbed from a gold cyanide solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold cyanide solution contained 100 mg/L Au.
pH = 12.62.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold cyanide solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

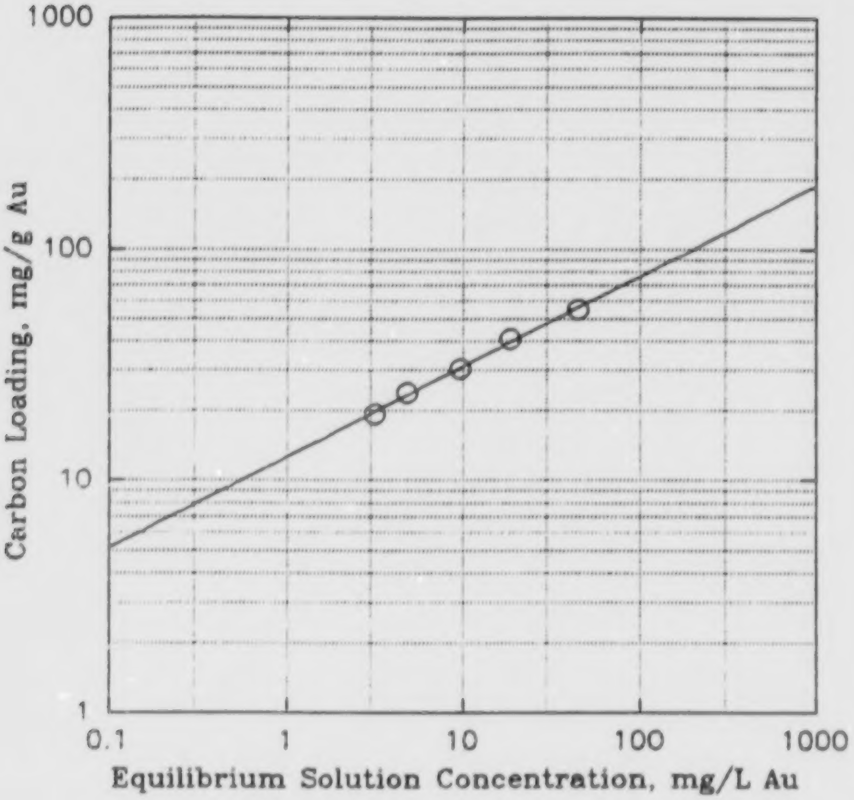
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

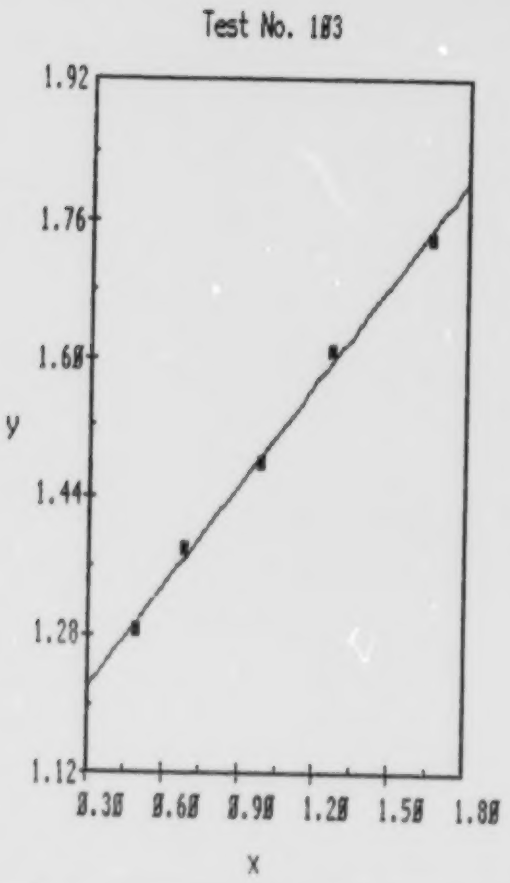
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	45.11	54.89
0.40	100.00	18.44	40.78
0.60	100.00	9.60	30.13
0.80	100.00	4.80	23.80
1.00	100.00	3.15	19.37

From graph: K-value = 12.6 mg/g



K-Value Calculation for Test No. 103



```
Enter the value of x.  x= » 0 no
( F8 to leave. )
            0.4983 < x < 1.6543
 Please note the limits and enter a new value.
```

Test No. 103

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

```
P(x)= 1.1012+ 0.3909x


Degree   1        ┌─────────┐
                  │    1    │
  a0   1.1012     │  1.1012 │
  a1   0.3909     │  0.3909 │
  a2              │         │
  a3              │         │
  a4              │         │
  a5              │         │
  var  1.59×10^-4 │1.59×10^-4│
                  └─────────┘


┌──────────────────── RESULTS OPTIONS ────────────────────┐
│         g. GRAPHICAL analysis of the current polynomial.  │
│  Use → or ← to select a different degree polynomial.      │
│F8 for SOLUTION OPTIONS.          F6 for helpful information.│
└───────────────────────────────────────────────────────────┘
```

Test No. 103

Purpose: Repeat the K-value (loading capacity) determination of a carbon sample adsorbed from a gold cyanide solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold cyanide solution contained 100 mg/L Au.
pH = 11.5

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

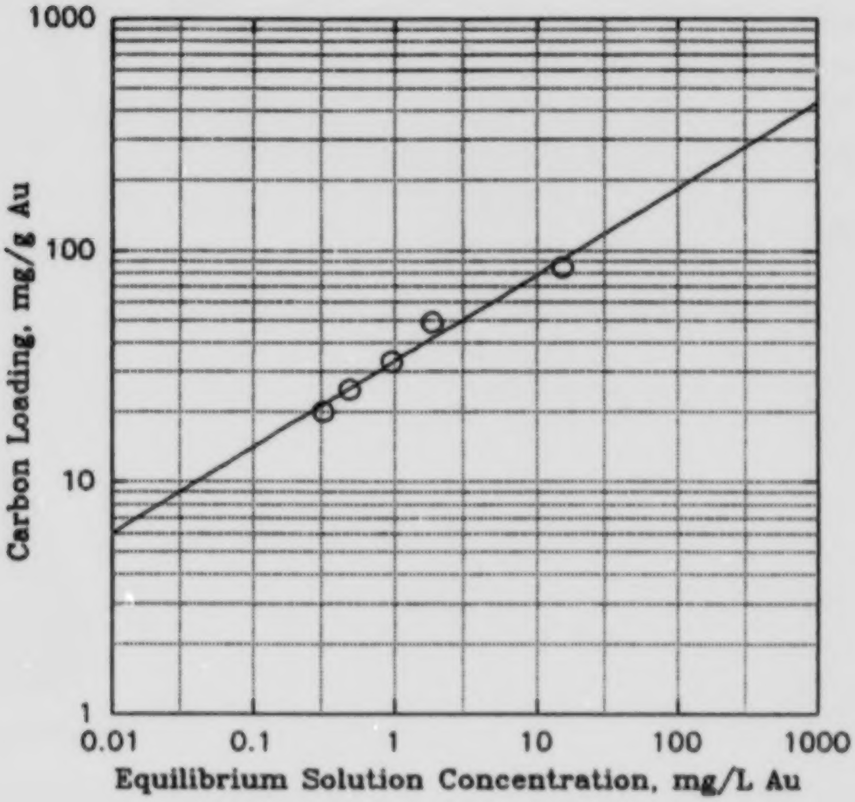
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	15.11	84.89
0.40	100.00	1.84	49.08
0.60	100.00	0.96	33.01
0.80	100.00	0.48	24.88
1.00	100.00	0.31	19.94

From graph: K-value = 33.27 mg/g



K-Value Calculation for Test No. 103

Test No. 104

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold cyanide solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold cyanide solution contained 10 mg/L Au.
pH = 11.8.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^{0} C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold cyanide solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.97				6.30		

$$\begin{aligned}\text{R value (\%)} &= 100*(9.97 - 6.30)/9.97 \\ &= 36.8\end{aligned}$$

Test No. 104

Purpose: Repeat the R-value determination on fresh carbon in NaCN-NaOH solution.

Sample: Fresh Calgon 6X16 activated carbon.

Solution: Gold cyanide solution contained 10 mg/L Au.
pH = 11.5.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.30

R value (%) = 100*(9.98 - 6.30)/9.98
= 37.0

Test No. 105

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 500° C, 60 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.55

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

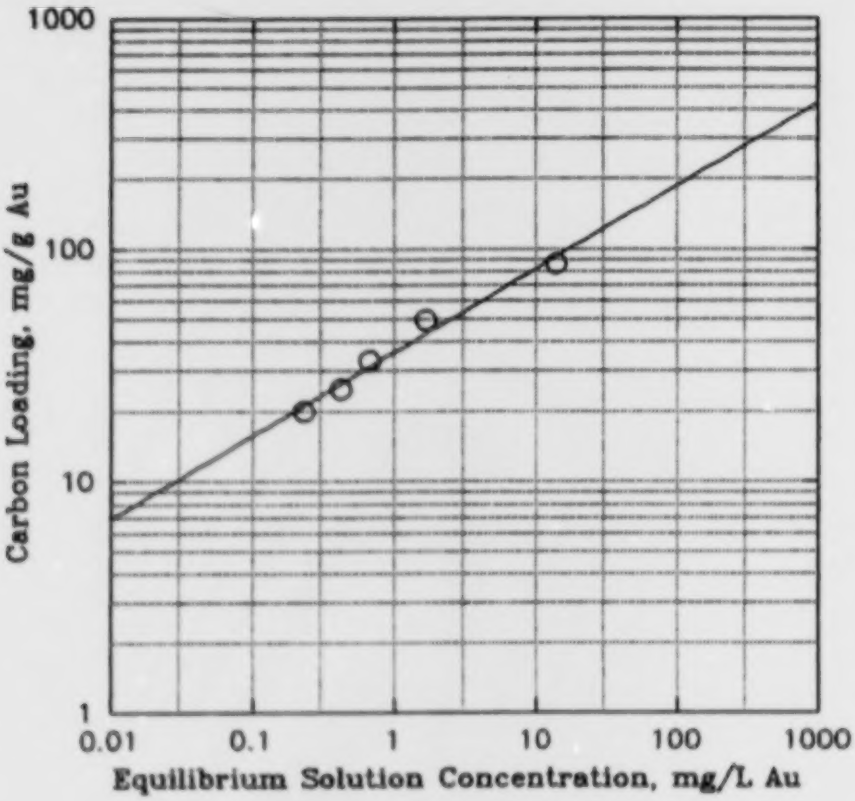
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	13.90	84.10
0.40	100.00	1.67	49.17
0.60	100.00	0.67	33.11
0.80	100.00	0.42	24.90
1.00	100.00	0.23	19.95

From graph: K-value = 38.89 mg/g



K-Value Calculation for Test No. 105

Test No. 106

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 500° C, 60 minutes. With moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	5.47

R value (%) = 100*(9.99 - 5.47)/9.99
= 44.4

Test No. 107

Purpose: To repeat the R-value (gold adsorption rate) determination of a carbon sample adsorbed from a gold cyanide solution (repeat Test No 99).

Sample: Test No. 81 carbon sample eluted with NaCN-NaOH.

Solution: Gold cyanide solution contained 10 mg/L Au.
pH = 11.45.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	6.99

R value (%) = 100*(9.99 - 6.99)/9.99
= 30.1

Test No. 108

Purpose: To re-check the K-value (loading capacity) of a fresh carbon sample adsorbed from a gold thiourea solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.55

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

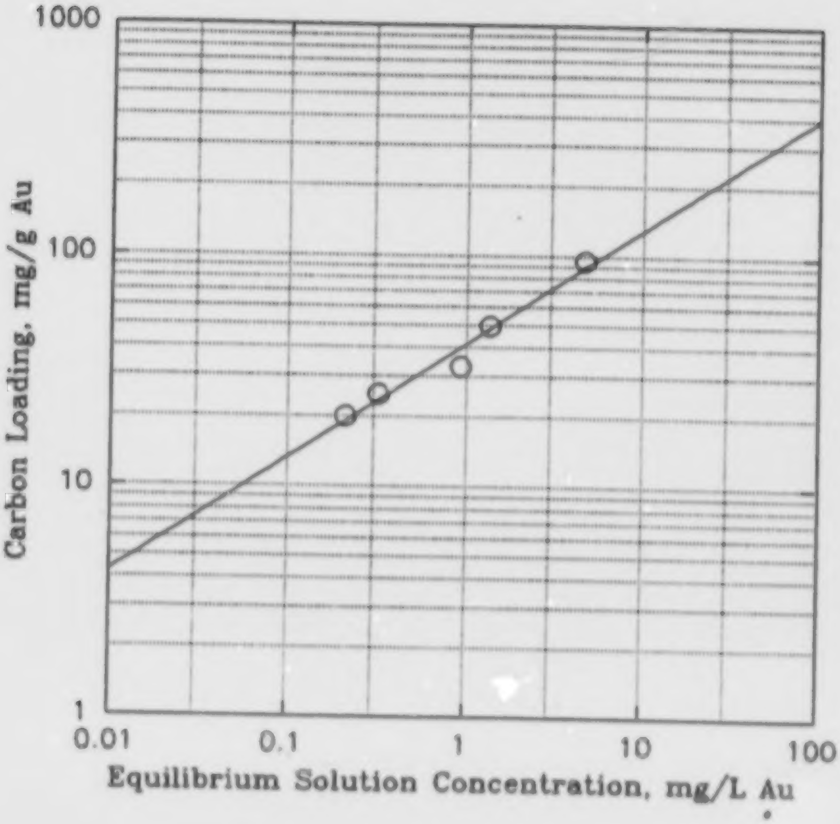
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	4.73	95.27
0.40	100.00	1.36	49.32
0.60	100.00	0.93	33.02
0.80	100.00	0.32	24.92
1.00	100.00	0.21	19.96

From graph: K-value = 41.88 mg/g



K-Value Calculation for Test No. 108

Test No. 109

Purpose: To repeat the R-value (gold adsorption rate) determination of a carbon sample adsorbed from a gold thiourea solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.50.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.257

R value (%) = 100*(9.98 - 6.257)/9.98
= 37.25

Test No. 110

Purpose: To determine the K-value (loading capacity) of a regenerated carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated butanol thiourea solution (Test No. 69). Regenereted in a horizontal rotary furnace at 700° C for one hour in a steam atmosphere.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.70.

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

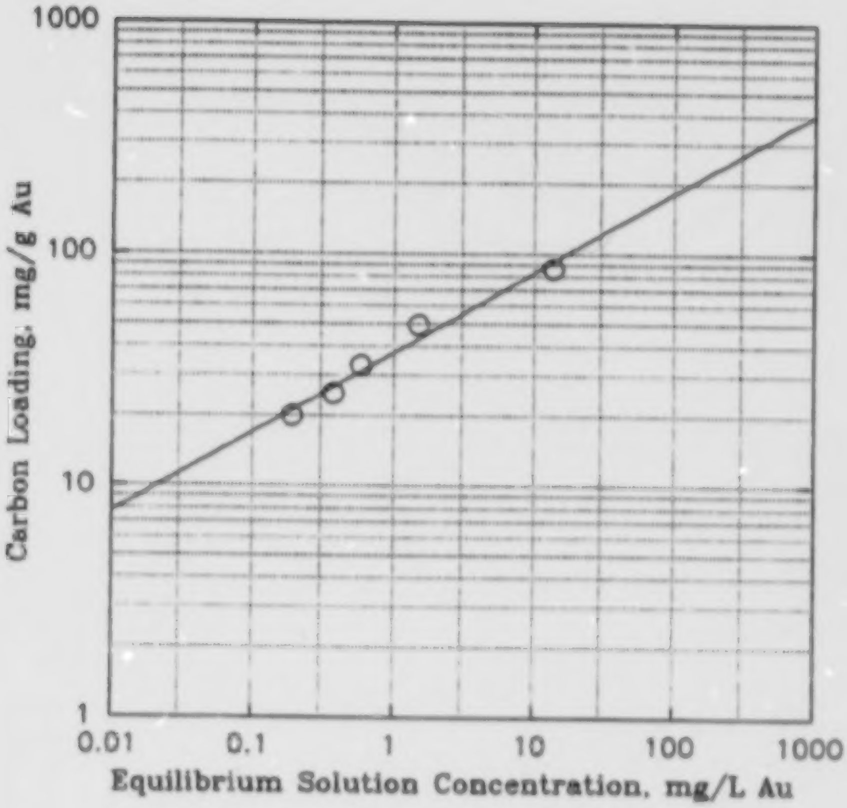
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

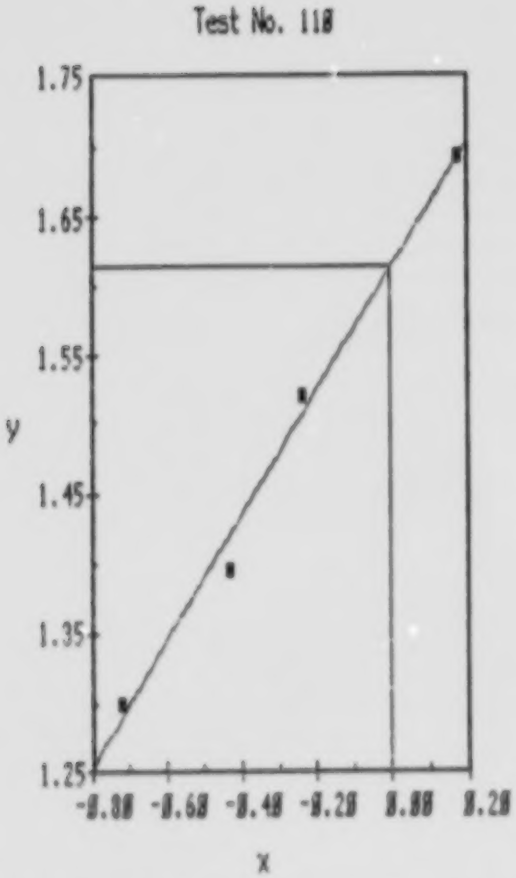
Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	13.84	86.16
0.40	100.00	1.49	49.26
0.60	100.00	0.58	33.14
0.80	100.00	0.37	24.91
1.00	100.00	0.19	19.96

From graph: K-value = 41.1 mg/g



K-Value Calculation for Test No. 110



```
x= 0.0                y= 1.6139

       Press any key for options.
```

Test No. 110

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

```
P(x)= 1.6139+ 0.4491x

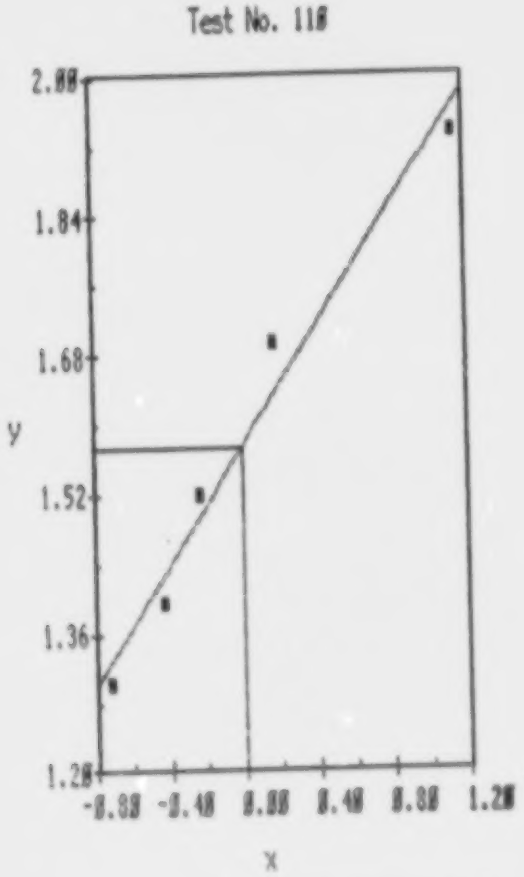


Degree   1
  a0     1.6139
  a1     0.4491
  a2
  a3
  a4
  a5
  var    4.10×10^-4



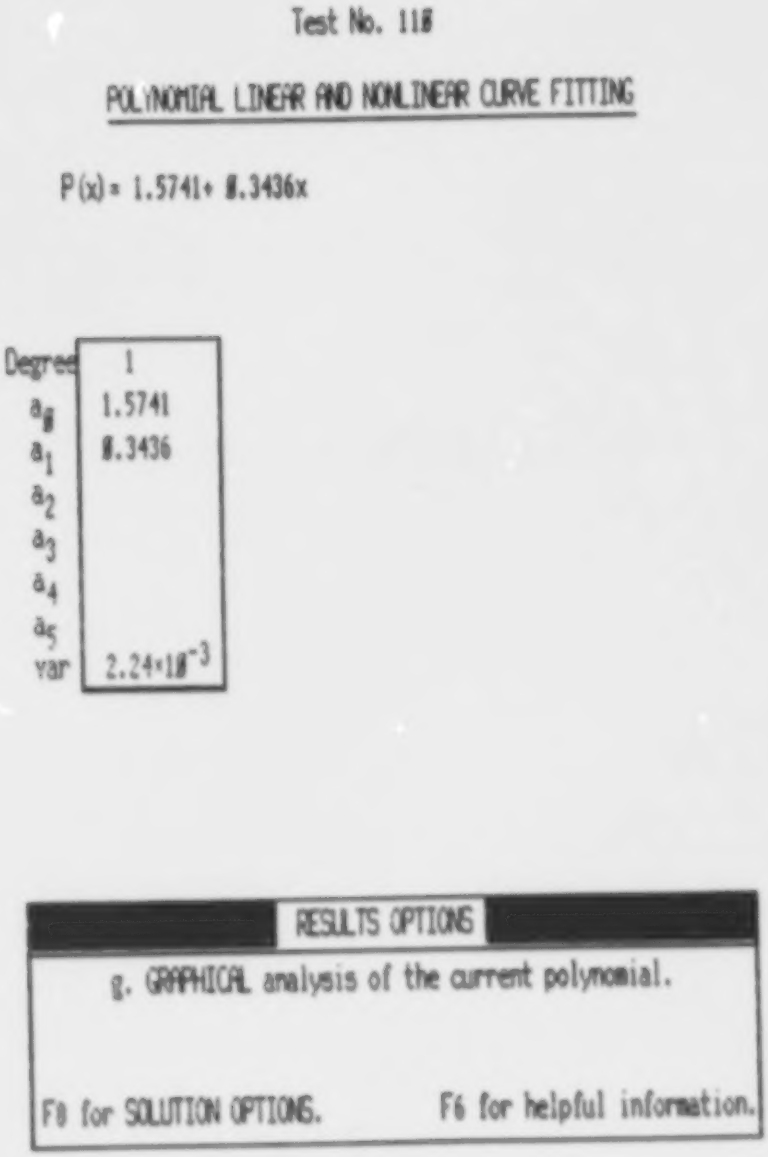
                 RESULTS OPTIONS
      g. GRAPHICAL analysis of the current polynomial.


F8 for SOLUTION OPTIONS.        F6 for helpful information.
```



```
x= 0.0          y= 1.5741

   Press any key for options.
```



Test No. 110

POLYNOMIAL LINEAR AND NONLINEAR CURVE FITTING

$P(x) = 1.5741 + 0.3436x$

Degree	1
a_0	1.5741
a_1	0.3436
a_2	
a_3	
a_4	
a_5	
var	2.24×10^{-3}

RESULTS OPTIONS

g. GRAPHICAL analysis of the current polynomial.

F0 for SOLUTION OPTIONS. F6 for helpful information.

Test No. 111

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Stripped Calgon GRC 6X16 carbon eluted with high concentrated butanol thiourea solution (Test No. 69). Regenerated in a horizontal rotary furnace at 700° C for one hour in a steam atmosphere.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.70.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	15	30	45	60	75	90
Solution (mg/L Au)	9.97				6.08		

R value (%) = 100*(9.97 - 6.08)/9.97
= 39.0

Test No. 112

Purpose: To re-check the K-value (loading capacity) of a fresh carbon sample adsorbed from a gold thiourea solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.50

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

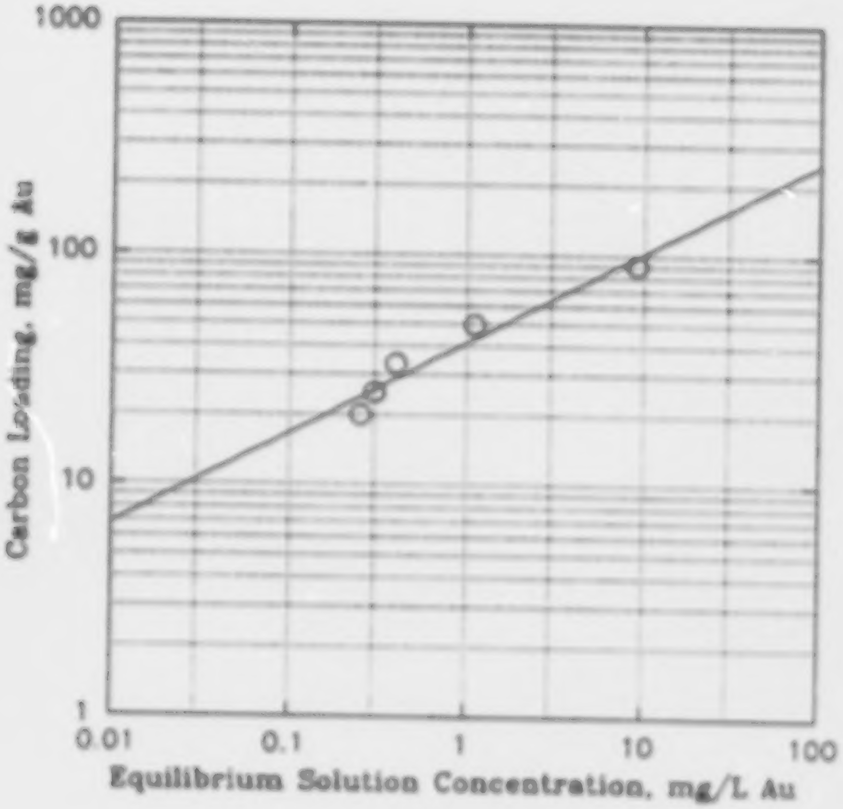
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	9.12	90.88
0.40	100.00	1.10	49.45
0.60	100.00	0.40	33.20
0.80	100.00	0.30	24.93
1.00	100.00	0.25	19.95

From graph: K-value = 41.21 mg/g



K-Value Calculation for Test No. 112

Test No. 113

Purpose: Repeat Test No. 90 for K-value determination

Sample: Eluted Calgon GRC 6x16 carbon with concentrated sodium sulphide solution (Test No. 80)

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

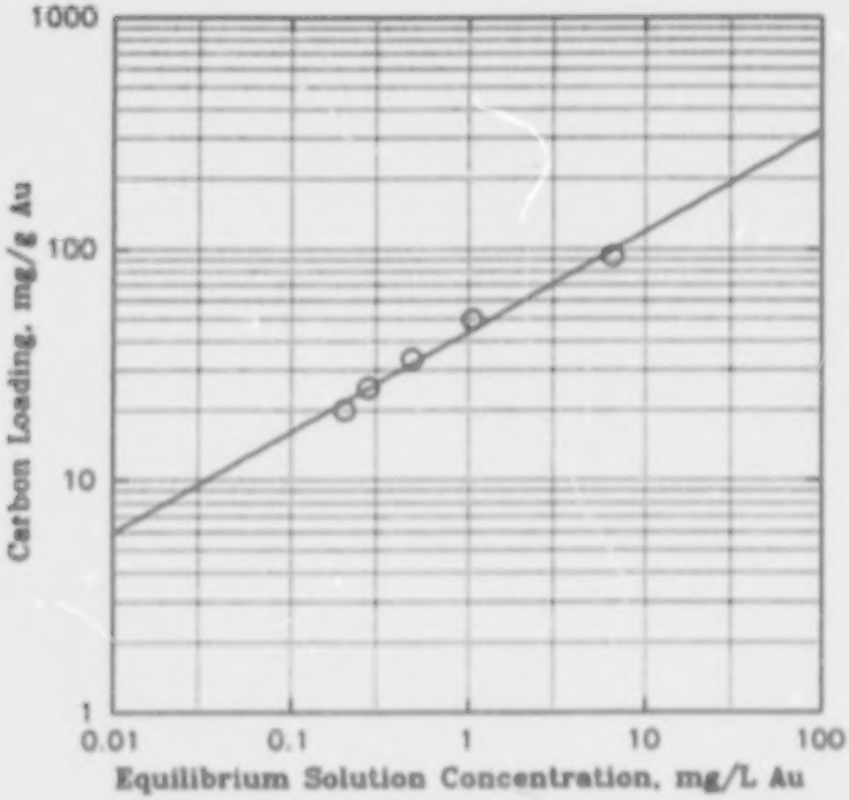
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.53	93.47
0.40	100.00	1.05	49.48
0.60	100.00	0.48	33.17
0.80	100.00	0.27	24.93
1.00	100.00	0.20	19.96

From graph: K-value = 43.85 mg/g



K-Value Calculation for Test No. 113

Test No. 114

Purpose: Repeat Test No. 103 for K-value determination in the gold cyanide in a lower pH solution.

Sample: Fresh Calgon GRC 6X16 carbon.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 11.50

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

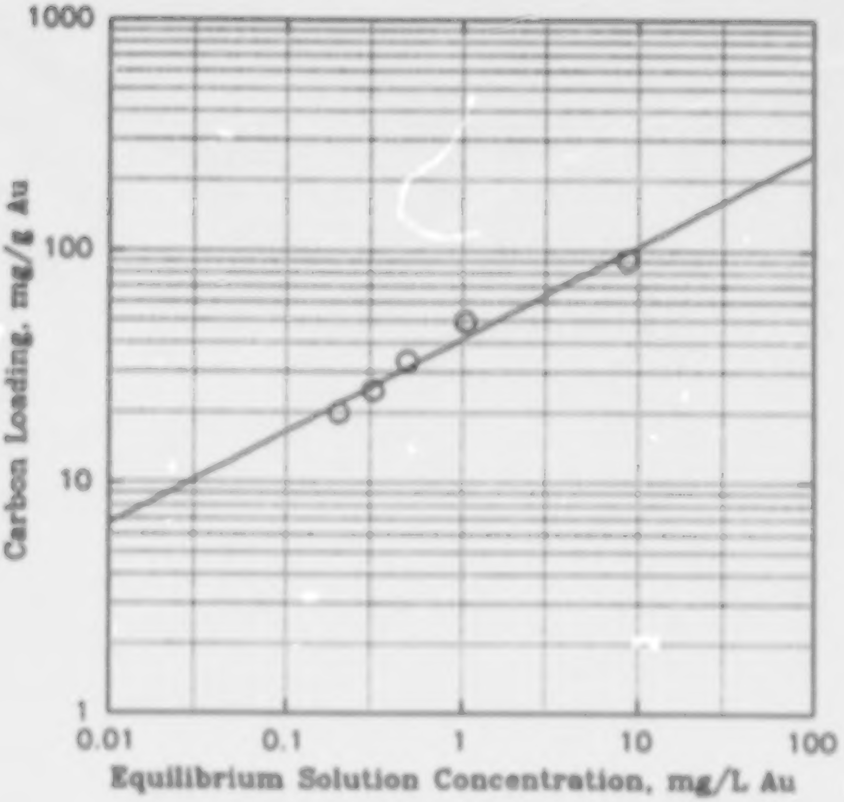
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	8.73	91.27
0.40	100.00	1.04	49.48
0.60	100.00	0.49	33.17
0.80	100.00	0.31	24.92
1.00	100.00	0.20	19.96

From graph: K-value = 41.59 mg/g



K-Value Calculation for Test No. 114

Test No. 115

Purpose: Repeat Test No. 92 for K-value determination in the gold thiourea solution

Sample: Stripped carbon eluted with high concentration butanol thiouea solution (Test No. 76).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 70 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

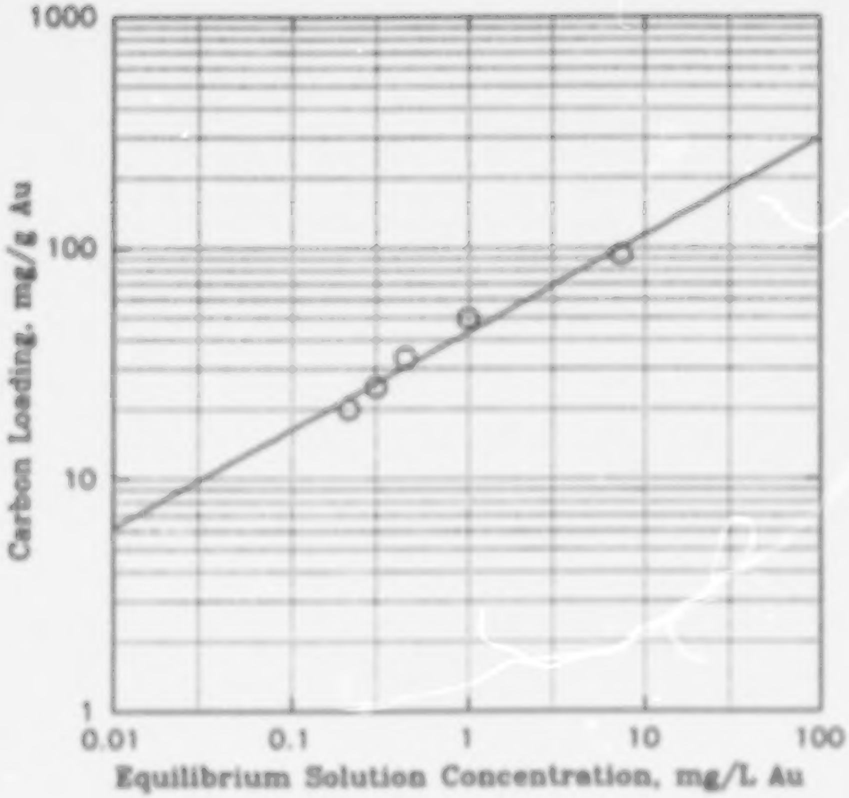
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.33	92.67
0.40	100.00	0.98	49.51
0.60	100.00	0.44	33.19
0.80	100.00	0.30	24.93
1.00	100.00	0.21	19.96

From graph: K-value = 43.15 mg/g



K-Value Calculation for Test No. 115

Test No. 116

Purpose: K-value determination on the second cycle of Test No. 80 eluted carbon.

Sample: Second cycle eluted carbon of Test No. 80.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

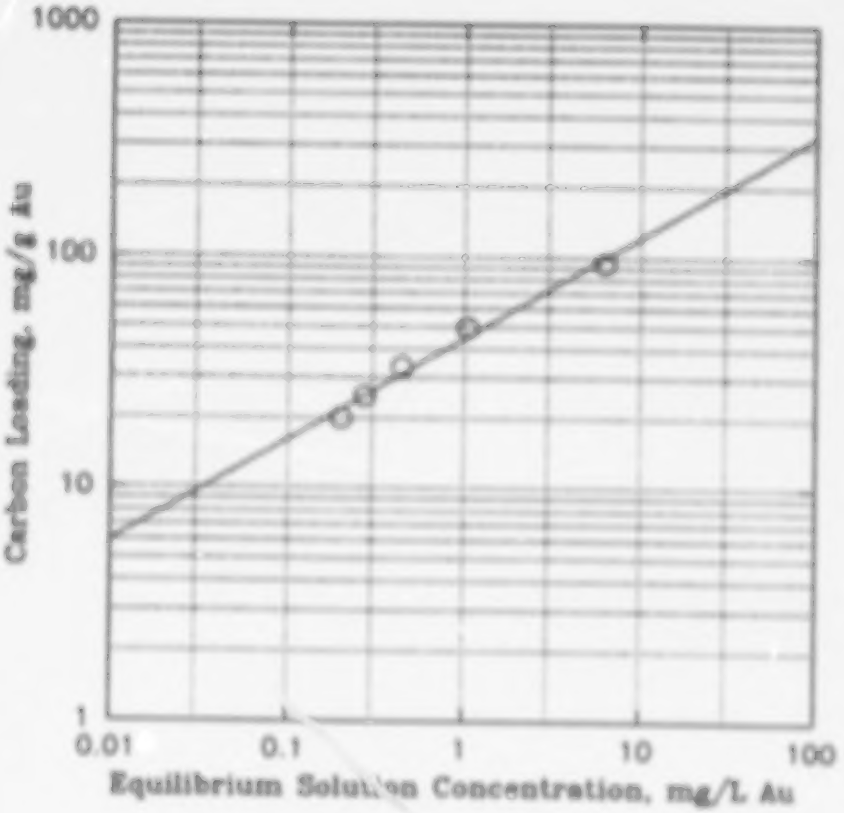
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.31	93.69
0.40	100.00	1.04	49.48
0.60	100.00	0.44	33.19
0.80	100.00	0.27	24.93
1.00	100.00	0.20	19.96

From graph: K-value = 44.36 mg/g



K-Value Calculation for Test No. 116

Test No. 117

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 80 carbon sample eluted two times .

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.82

R value (%) = 100*(9.98 - 6.82)/9.98
= 31.6

Test No. 118

Purpose: K-value determination on the third cycle of Test No. 80 eluted carbon.

Sample: Third cycle eluted carbon of Test No. 80.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

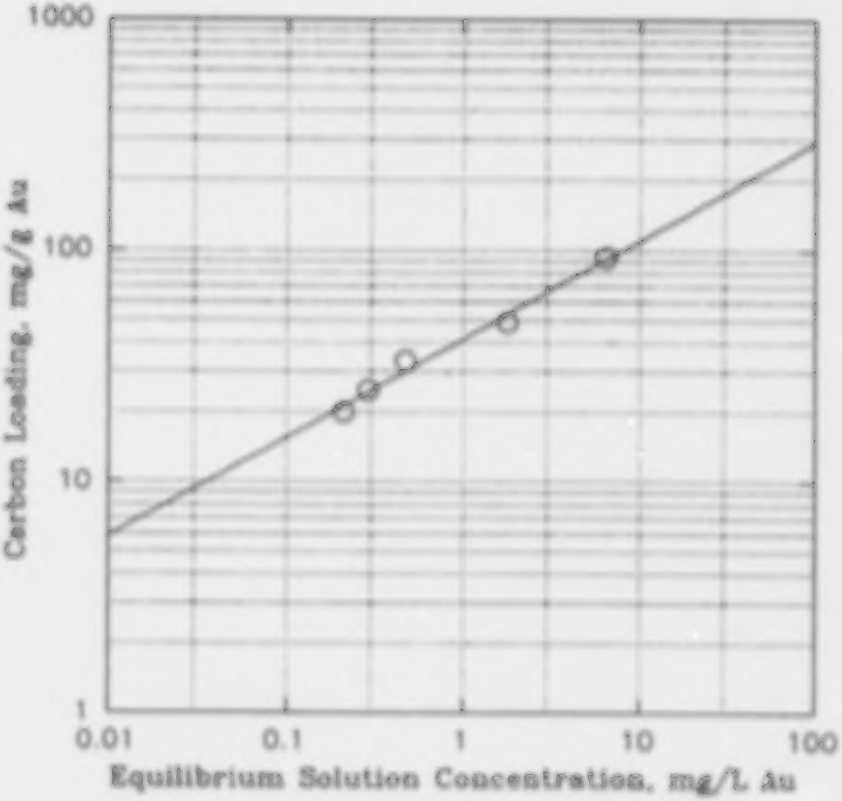
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.51	93.49
0.40	100.00	1.78	49.11
0.60	100.00	0.47	33.16
0.80	100.00	0.29	24.93
1.00	100.00	0.21	19.96

From graph: K-value = 41.30 mg/g



K-Value Calculation for Test No. 118

Test No. 119

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 80 carbon sample eluted three times .

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.94

$$R \text{ value } (\%) = 100*(9.98 - 6.94)/9.98$$
$$= 30.6$$

Test No. 120

Purpose: K-value determination on the fourth cycle of Test No. 80 eluted carbon.

Sample: Fourth cycle eluted carbon of Test No. 80.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.50

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

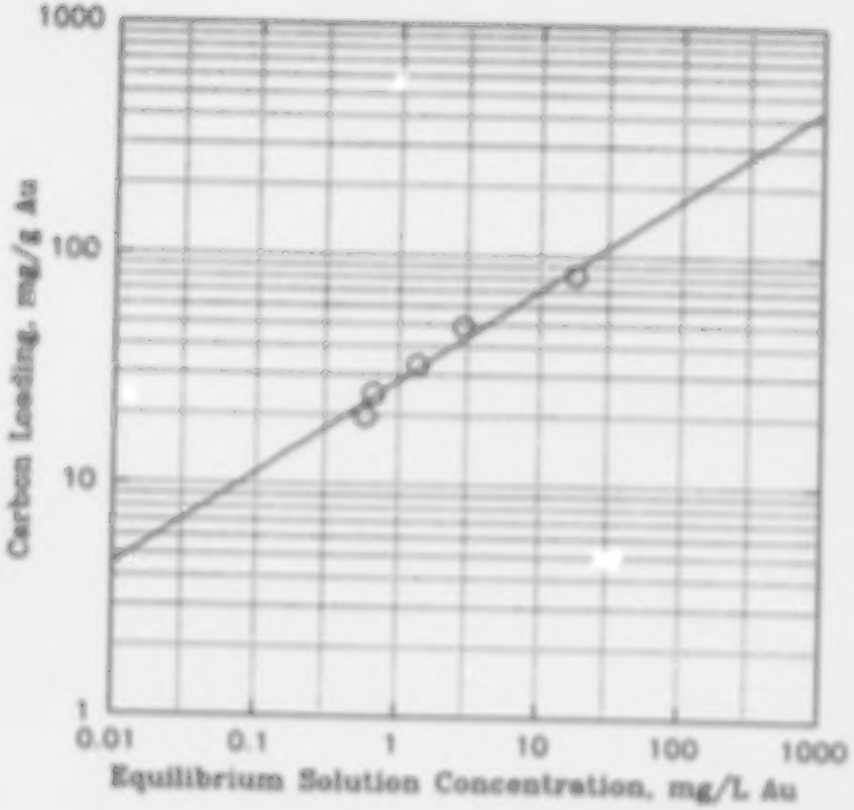
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	17.71	82.29
0.40	100.00	2.86	48.57
0.60	100.00	1.36	32.88
0.80	100.00	0.66	24.84
1.00	100.00	0.58	19.88

From graph: K-value = 28.15 mg/g



K-Value Calculation for Test No. 120

Test No. 121

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 80 carbon sample eluted four times .

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.51.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	7.17

$$\begin{aligned} R \text{ value } (\%) &= 100*(9.98 - 7.17)/9.98 \\ &= 28.3 \end{aligned}$$

Test No. 122

Purpose: K-value determination on the first cycle of Test No. 81 eluted carbon.

Sample: First cycle eluted carbon of Test No. 81.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.50

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

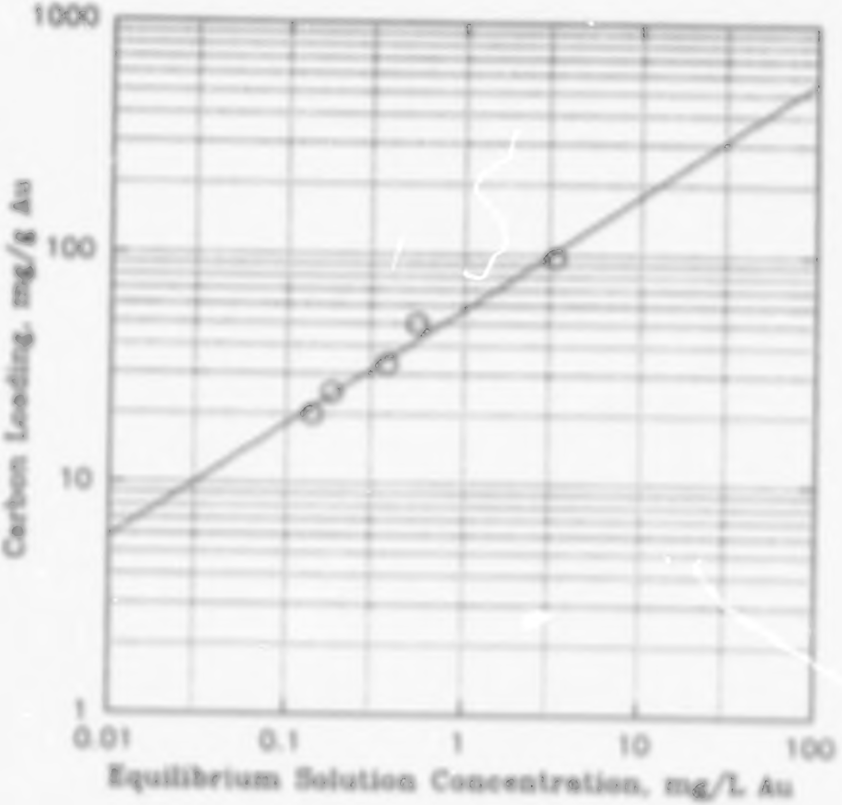
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	3.23	96.77
0.40	100.00	0.55	49.73
0.60	100.00	0.37	33.21
0.80	100.00	0.18	24.96
1.00	100.00	0.14	19.97

From graph: K-value = 57.15 mg/g



K-Value Calculation for Test No. 122

Test No. 123

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 81 carbon sample.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.50.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.39

$$R \text{ value } (\%) = 100*(9.98 - 5.39)/9.98$$
$$= 46.1$$

Test No. 124

Purpose: K-value determination on the fifth cycle of Test No. 80 eluted carbon.

Sample: Fifth cycle eluted carbon of Test No. 80.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

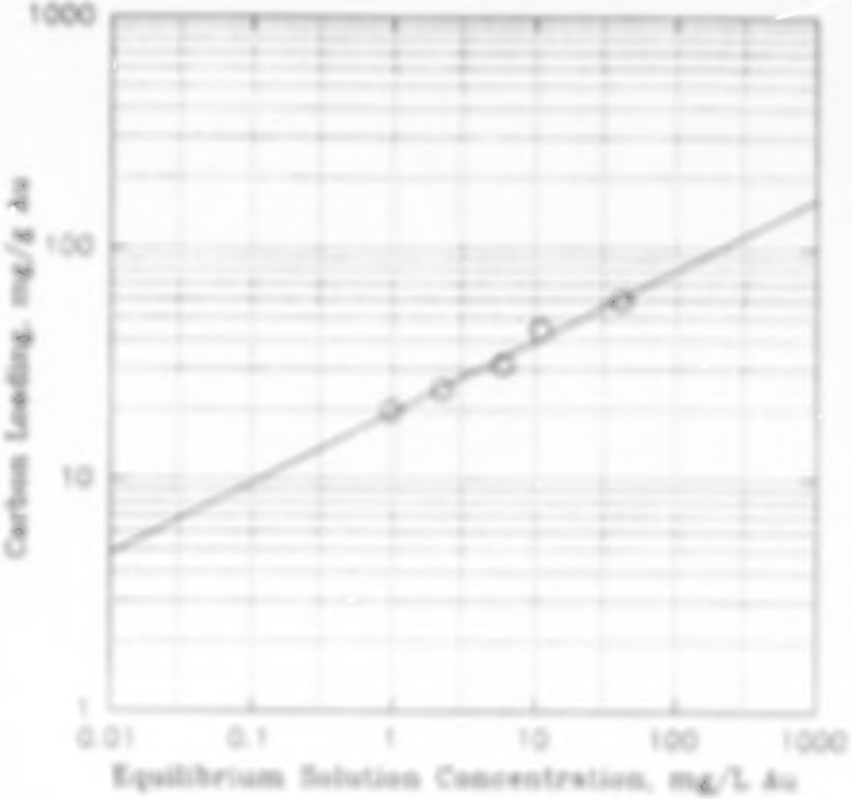
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	40.58	59.42
0.40	100.00	10.89	44.56
0.60	100.00	5.89	31.37
0.80	100.00	2.22	24.45
1.00	100.00	0.97	19.81

From graph: K-value = 19.59 mg/g



K-Value Calculation for Test No. 124

Test No. 125

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 80 carbon sample of five stages recycle.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.52.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	7.80

R value (%) = 100*(9.99 - 7.80)/9.99
= 22.0

Test No. 126

Purpose: K-value determination on the second cycle of Test No. 81 eluted carbon.

Sample: Second cycle eluted carbon of Test No. 81.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.50

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

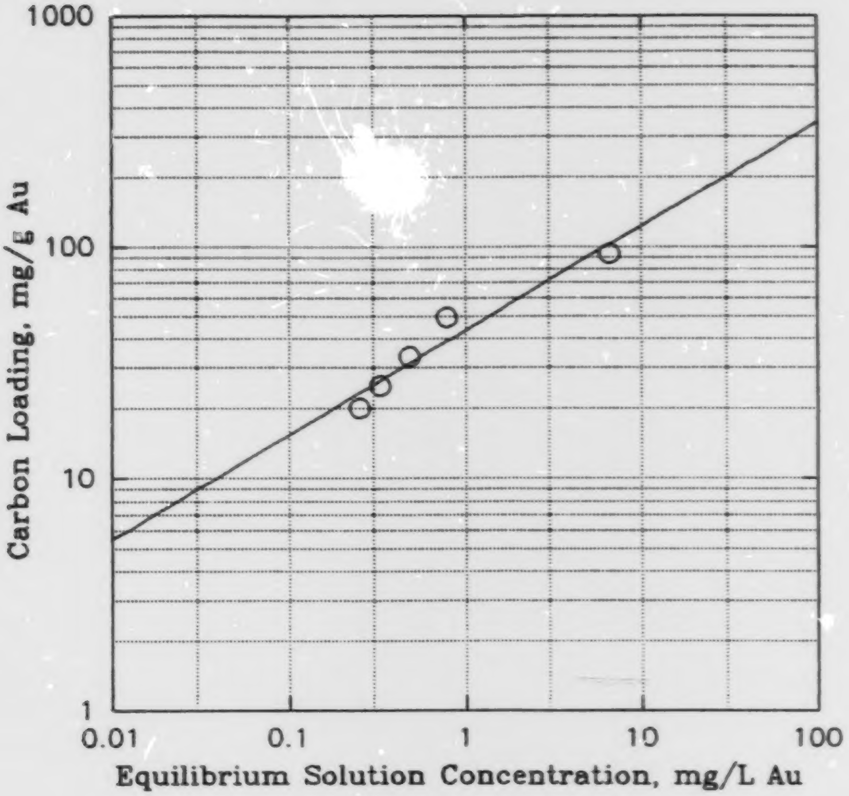
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.67	93.33
0.40	100.00	0.78	49.61
0.60	100.00	0.48	33.17
0.80	100.00	0.33	24.92
1.00	100.00	0.25	19.95

From graph: K-value = 43.45 mg/g



K–Value Calculation for Test No. 126

Test No. 127

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 81 carbon sample of two stages recycle.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.51.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.53

R value (%) = 100*(9.98 - 5.53)/9.98
= 44.7

Test No. 128

Purpose: K-value determination on the third cycle of Test No. 81 eluted carbon.

Sample: Third cycle eluted carbon of Test No. 81.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.50

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

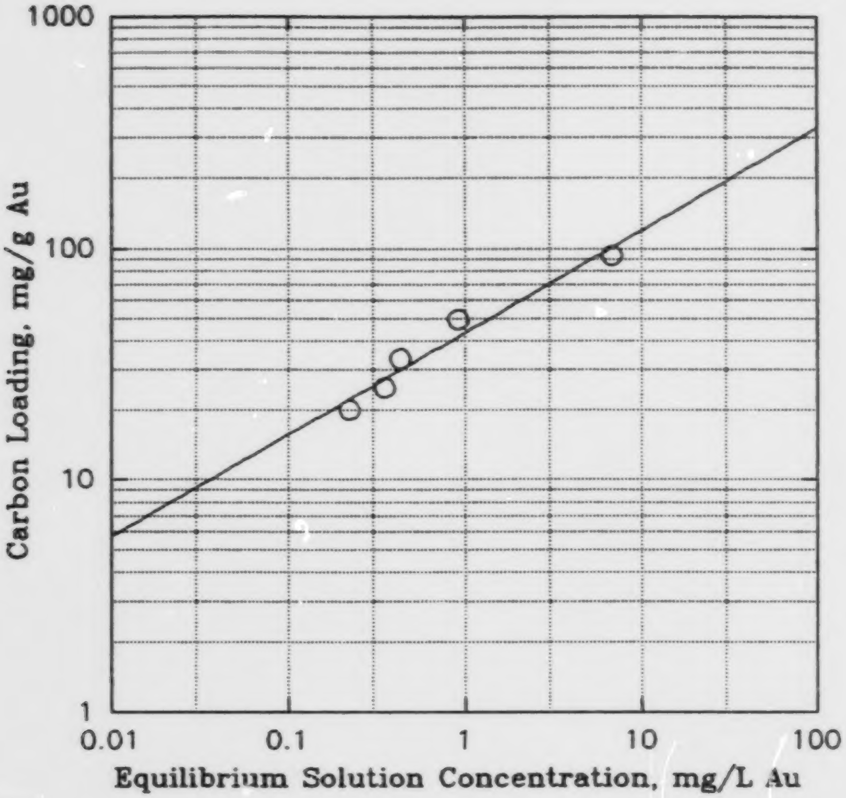
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.82	93.18
0.40	100.00	0.91	49.55
0.60	100.00	0.43	33.19
0.80	100.00	0.35	24.91
1.00	100.00	0.22	19.96

From graph: K-value = 42.36 mg/g



K-Value Calculation for Test No. 128

Test No. 129

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 81 carbon sample of three stages recycle.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.97

$$\text{R value (\%)} = 100*(9.98 - 5.97)/9.98$$
$$= 40.3$$

Test No. 130

Purpose: K-value determination on the fourth cycle of Test No. 81 eluted carbon.

Sample: Fourth cycle eluted carbon of Test No. 81.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

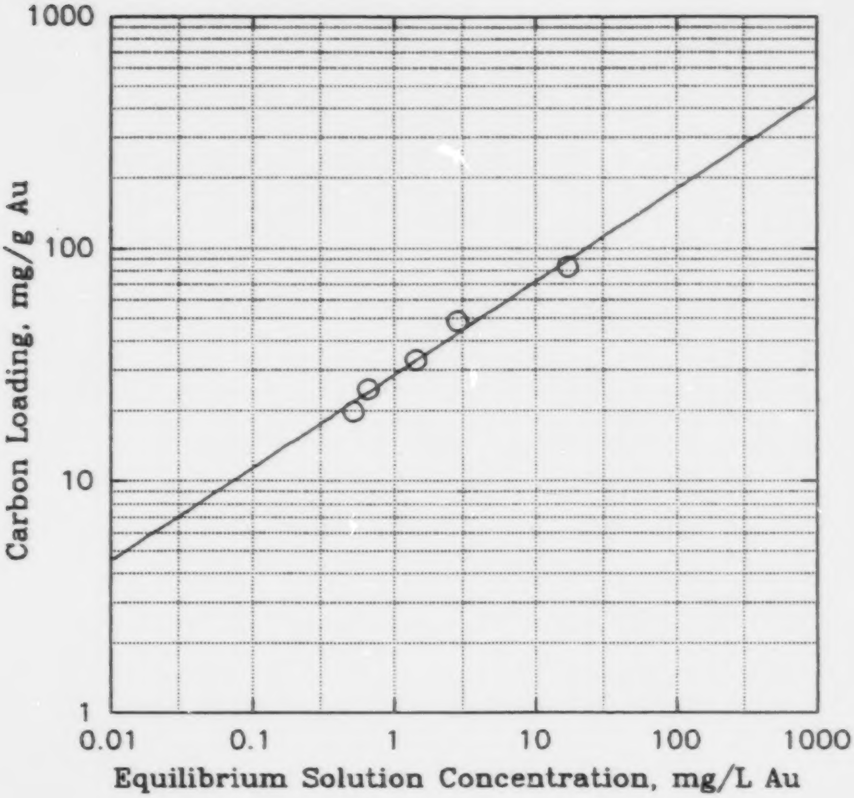
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	16.87	83.13
0.40	100.00	2.79	48.61
0.60	100.00	1.42	32.86
0.80	100.00	0.65	24.84
1.00	100.00	0.51	19.90

From graph: K-value = 28.58 mg/g



K-Value Calculation for Test No. 130

Test No. 131

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 81 carbon sample of four stages recycle.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^{0} C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	7.59

R value (%) = 100*(9.98 - 7.59)/9.98
= 24.1

Test No. 132

Purpose: K-value determination on the fifth cycle of Test No. 81 eluted carbon.

Sample: Fifth cycle eluted carbon of Test No. 81.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

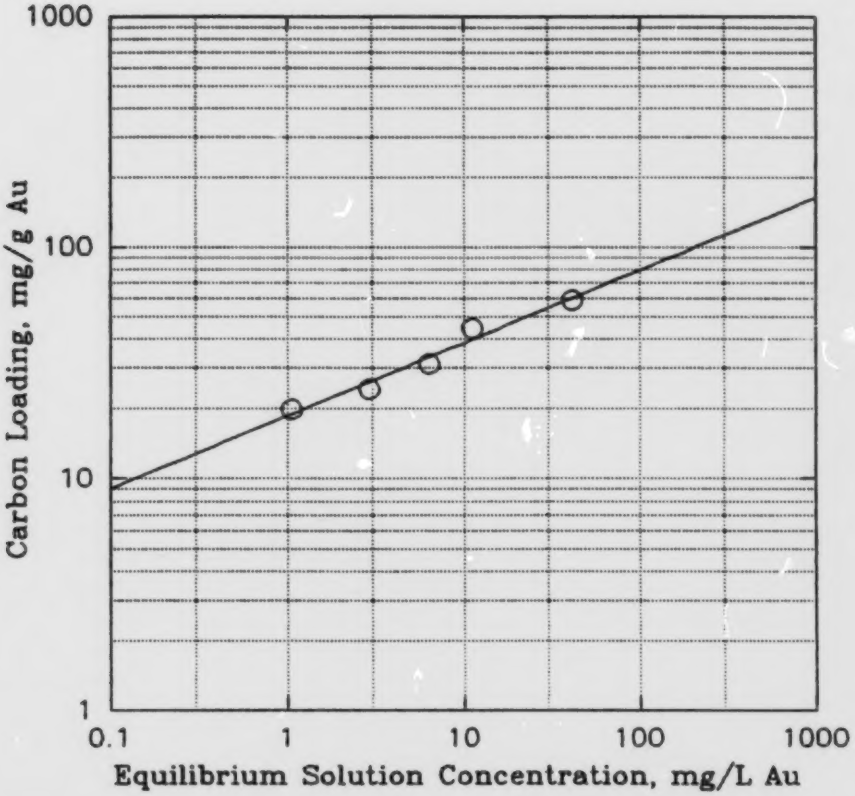
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	41.25	58.75
0.40	100.00	11.03	44.49
0.60	100.00	6.29	31.24
0.80	100.00	2.87	24.28
1.00	100.00	1.05	19.79

From graph: K-value = 18.71 mg/g



K-Value Calculation for Test No. 132

Test No. 133

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 81 carbon sample of five stages recycle.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	8.04

R value (%) = 100*(9.98 - 8.04)/9.98
= 19.6

Test No. 134

Purpose: K-value determination on Test No. 81 eluted carbon without acid wash.

Sample: Eluted carbon of Test No. 81.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.55

Procedure:

(1) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(2) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(3) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

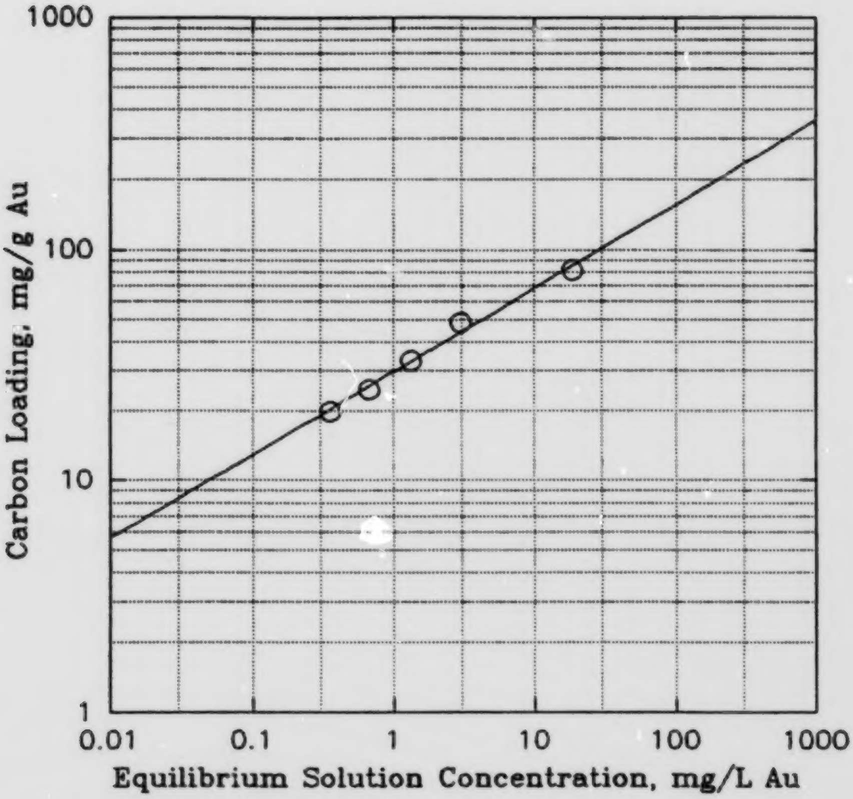
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	18.65	81.35
0.40	100.00	2.98	48.51
0.60	100.00	1.34	32.89
0.80	100.00	0.67	24.83
1.00	100.00	0.35	19.93

From graph: K-value = 29.65 mg/g



K–Value Calculation for Test No. 134

Test No. 135

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 81 carbon sample without acid wash.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.56.

Procedure:

(1) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(2) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	7.46

R value (%) = 100*(9.98 - 7.46)/9.98
= 25.4

Test No. 136

Purpose: K-value determination on Test No. 80 eluted carbon without acid wash.

Sample: Eluted carbon of Test No. 80.

Solution: Gold thiourea solution contained 100 mg/L Au. pH = 1.53

Procedure:

(1) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(2) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(3) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

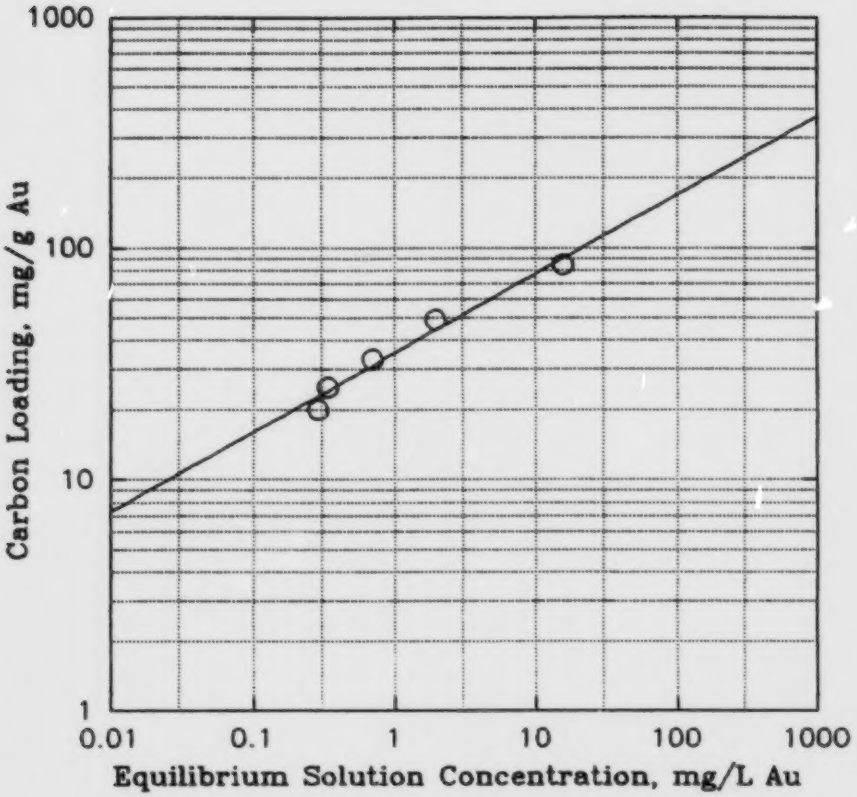
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	15.64	84.36
0.40	100.00	1.95	49.03
0.60	100.00	0.69	33.10
0.80	100.00	0.33	24.92
1.00	100.00	0.28	19.94

From graph: K-value = 35.24 mg/g



K–Value Calculation for Test No. 136

Test No. 137

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 80 carbon sample without acid wash.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.56.

Procedure:

(1) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(2) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.65

$$R \text{ value } (\%) = 100*(9.98 - 6.65)/9.98$$
$$= 33.5$$

Test No. 138

Purpose: K-value determination on Test No. 76 eluted carbon without acid wash.

Sample: Eluted carbon of Test No. 76.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.50

Procedure:

(1) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(2) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(3) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

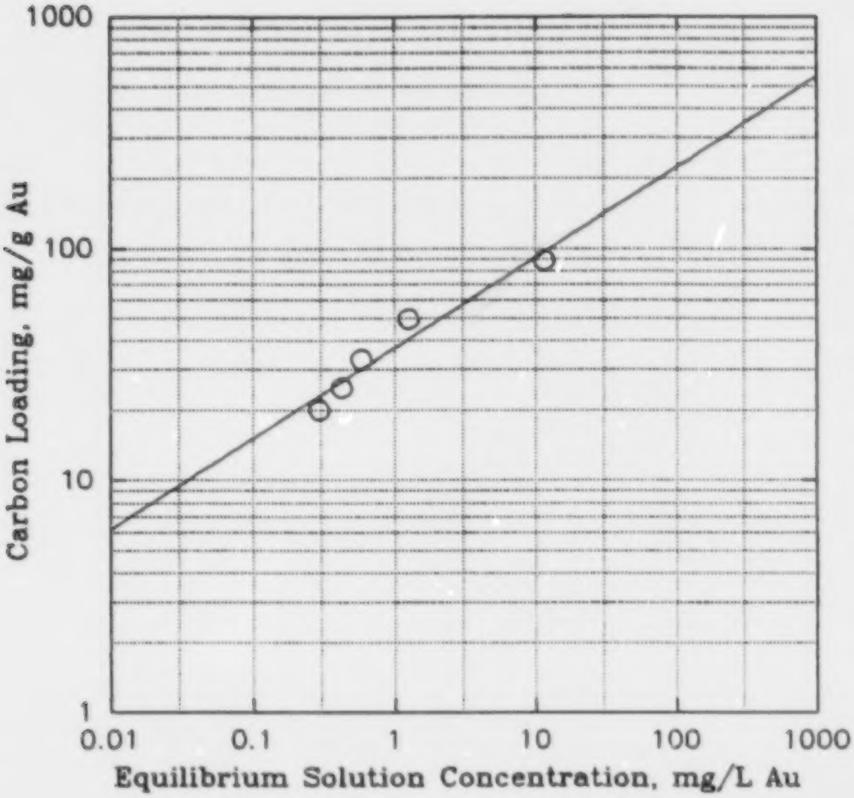
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	11.57	88.43
0.40	100.00	1.24	49.38
0.60	100.00	0.58	33.14
0.80	100.00	0.42	24.90
1.00	100.00	0.29	19.94

From graph: K-value = 37.24 mg/g



K–Value Calculation for Test No. 138

Test No. 139

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution

Sample: Test No. 76 carbon sample without acid wash.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(2) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.98

R value (%) = 100*(9.98 - 6.98)/9.98
= 30.2

Test No. 140

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 600^0 C, 20 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60^0 C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105^0 C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

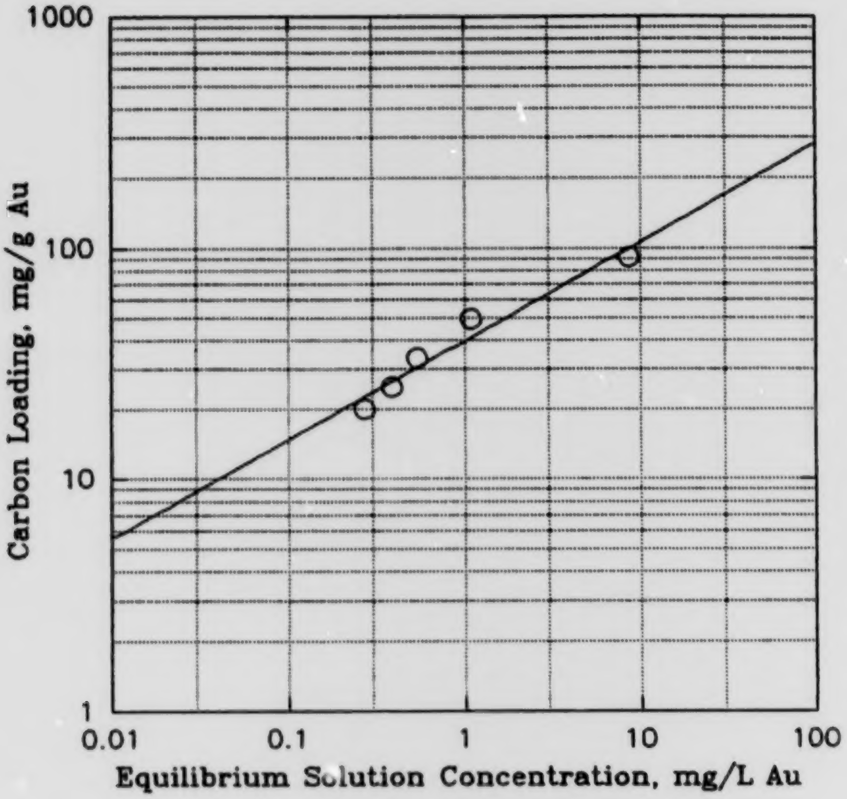
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	8.61	91.39
0.40	100.00	1.08	49.46
0.60	100.00	0.54	33.15
0.80	100.00	0.39	24.90
1.00	100.00	0.27	19.95

From graph: K-value = 39.63 mg/g



K–Value Calculation for Test No. 140

Test No. 141

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 600^0 C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.83

R value (%) = 100*(9.98 - 6.83)/9.98
= 31.7

Test No. 142

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700^0 C, 20 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60^0 C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105^0 C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

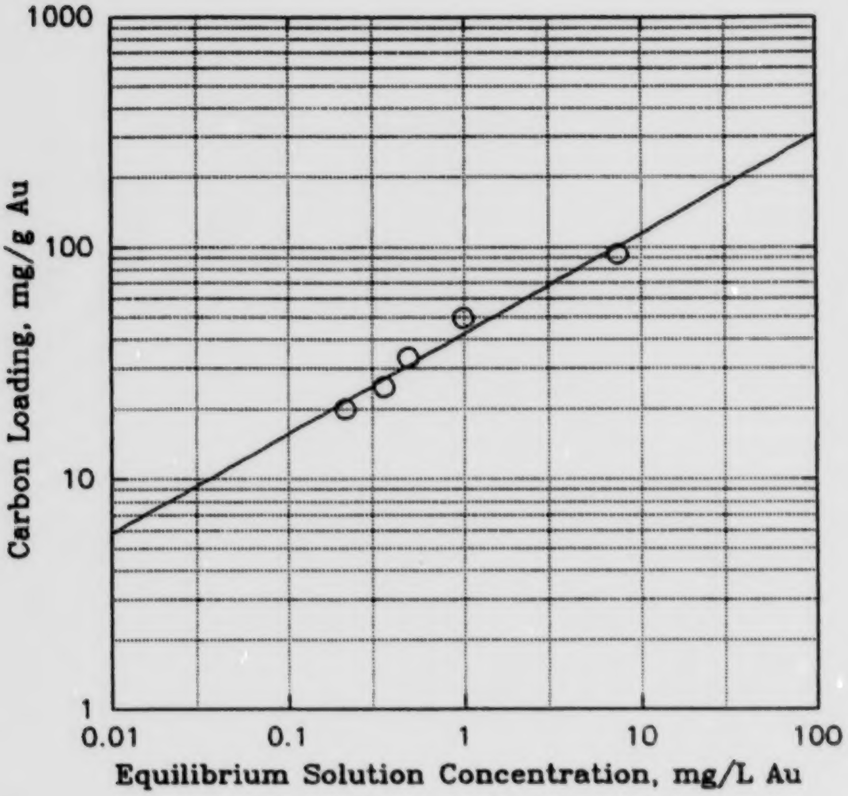
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.33	92.67
0.40	100.00	0.99	49.51
0.60	100.00	0.48	33.17
0.80	100.00	0.35	24.91
1.00	100.00	0.21	19.96

From graph: K-value = 42.36 mg/g



K–Value Calculation for Test No. 142

Test No. 143

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.15

$$\begin{aligned}\text{R value (\%)} &= 100*(9.98 - 6.15)/9.98 \\ &= 38.5\end{aligned}$$

Test No. 144

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 800^0 C, 20 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60^0 C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105^0 C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

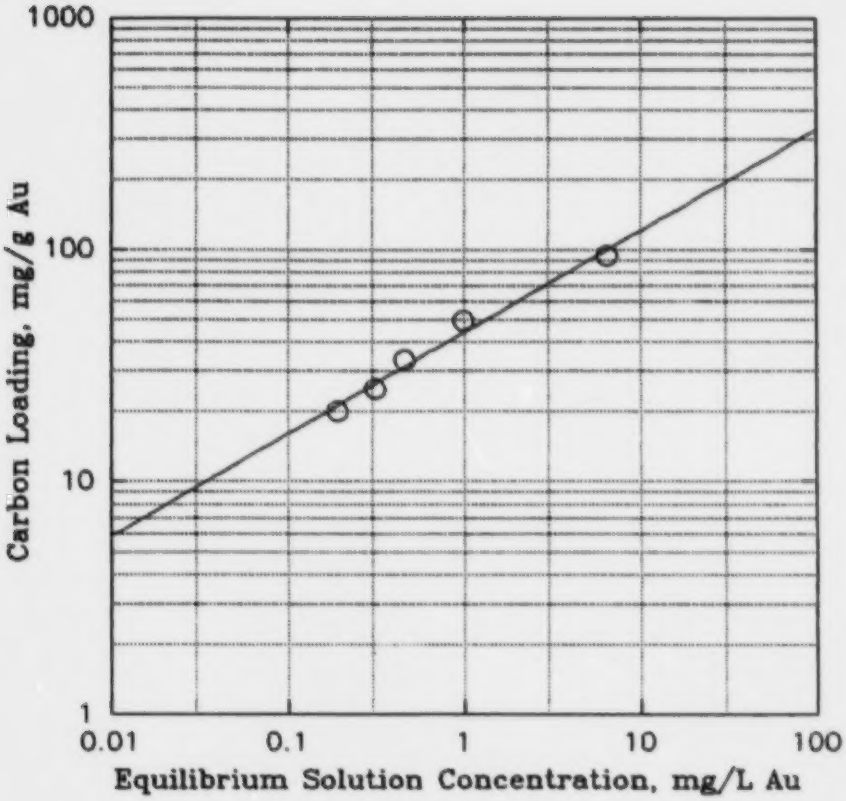
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.48	93.52
0.40	100.00	0.98	49.51
0.60	100.00	0.46	33.18
0.80	100.00	0.31	24.92
1.00	100.00	0.19	19.96

From graph: K-value = 44.06 mg/g



K-Value Calculation for Test No. 144

Test No. 145

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 800^0 C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.62

$$R \text{ value } (\%) = 100*(9.98 - 5.62)/9.98 = 43.8$$

Test No. 146

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 500° C, 20 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

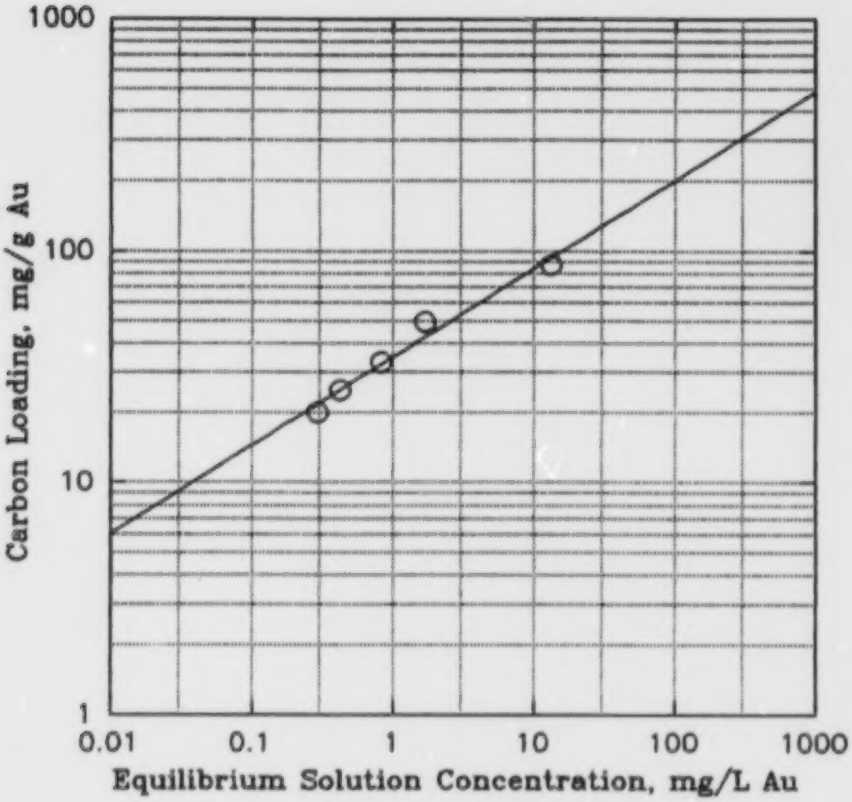
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	13.25	86.75
0.40	100.00	1.68	49.16
0.60	100.00	0.83	33.06
0.80	100.00	0.42	24.90
1.00	100.00	0.29	19.94

From graph: K-value = 34.83 mg/g



K-Value Calculation for Test No. 146

Test No. 147

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 500° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.78

$$\text{R value (\%)} = 100*(9.98 - 6.78)/9.98$$
$$= 32.2$$

Test No. 148

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 800^0 C, 40 minutes, without moisture. (Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60^0 C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105^0 C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

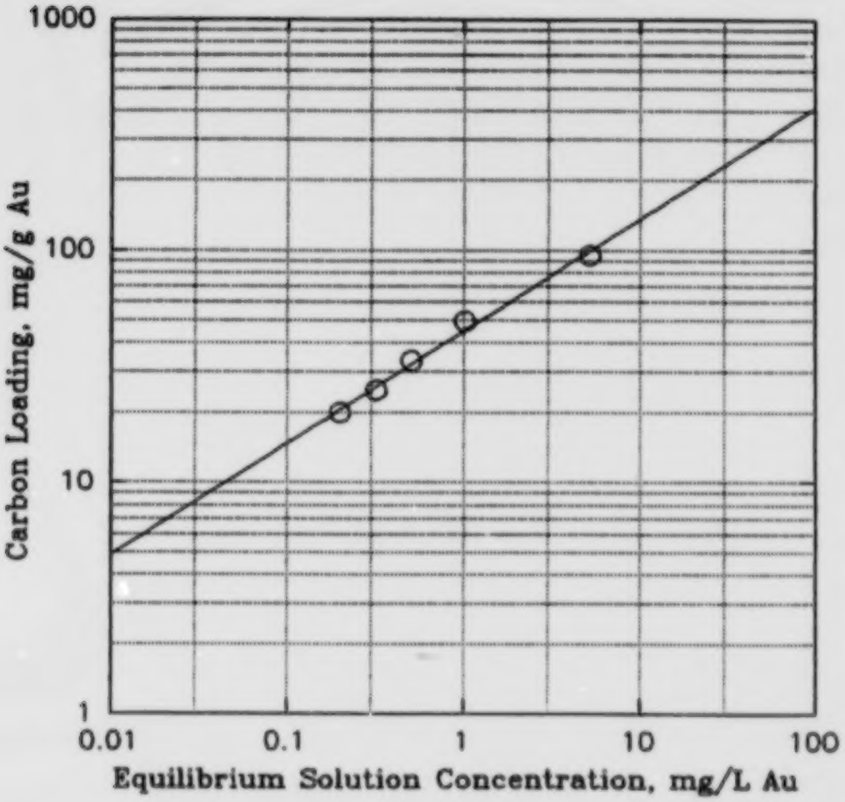
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	5.23	94.77
0.40	100.00	1.01	49.50
0.60	100.00	0.51	33.16
0.80	100.00	0.32	24.92
1.00	100.00	0.20	19.96

From graph: K-value = 44.77 mg/g



K-Value Calculation for Test No. 148

Test No. 149

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 800° C, 40 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.51

R value (%) = 100*(9.98 - 5.51)/9.98
= 44.9

Test No. 150

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 800° C, 60 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

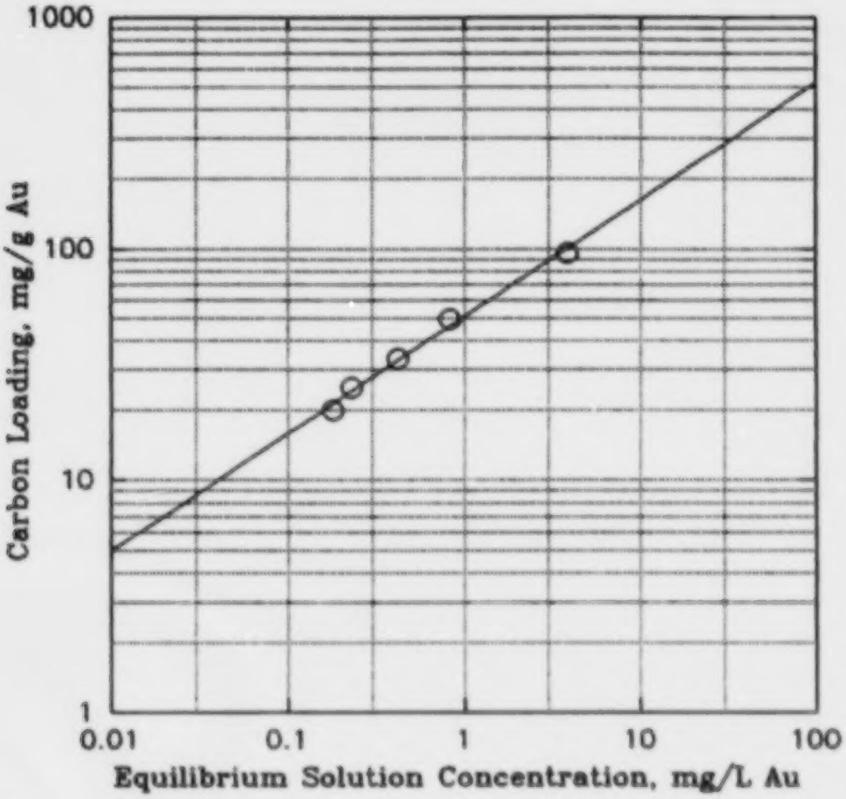
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	3.81	96.19
0.40	100.00	0.82	49.59
0.60	100.00	0.42	33.19
0.80	100.00	0.23	24.94
1.00	100.00	0.18	19.96

From graph: K-value = 50.35 mg/g



K–Value Calculation for Test No. 150

Test No. 151

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 800° C, 60 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	5.35

$$\text{R value (\%)} = 100*(9.99 - 5.35)/9.99$$
$$= 46.5$$

Test No. 152

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700° C, 40 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log(X/M) = \log(KC)$$

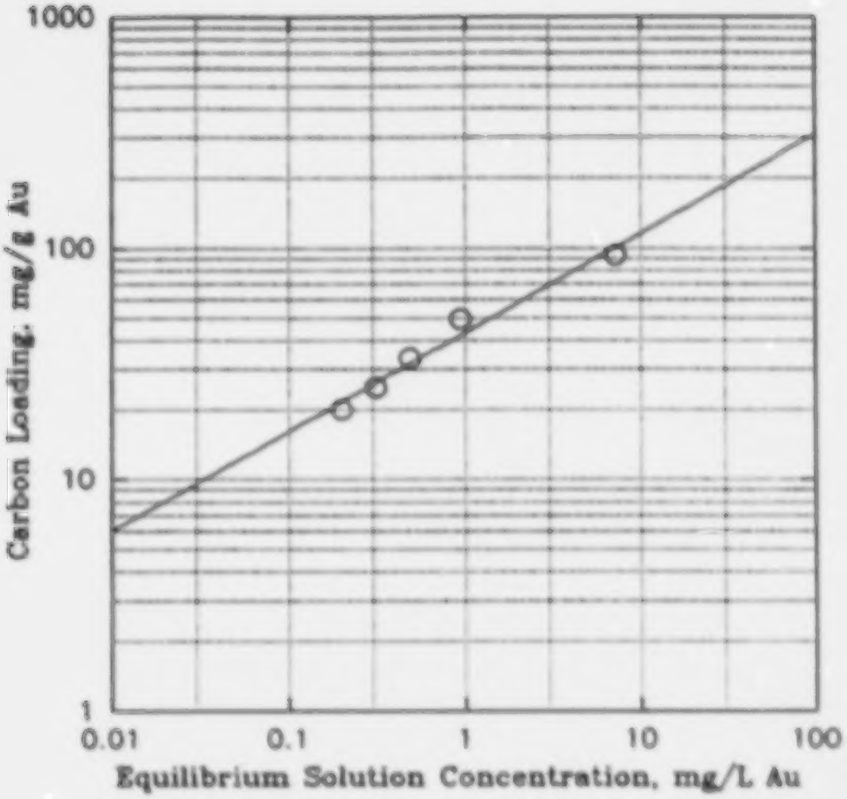
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.13	92.87
0.40	100.00	0.94	49.53
0.60	100.00	0.49	33.17
0.80	100.00	0.31	24.92
1.00	100.00	0.20	19.96

From graph: K-value = 43.15 mg/g



K-Value Calculation for Test No. 152

Test No. 153

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 700^0 C, 40 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	6.06

R value (%) = 100*(9.99 - 6.06)/9.99
= 39.4

Test No. 154

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700° C, 60 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.53

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

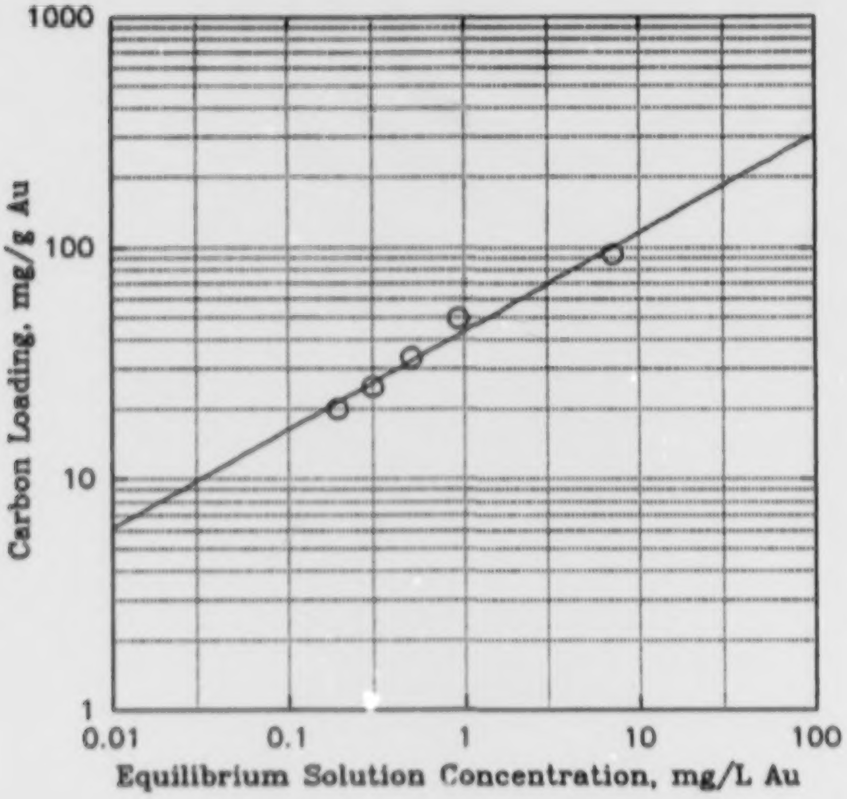
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.10	92.90
0.40	100.00	0.93	49.54
0.60	100.00	0.50	33.17
0.80	100.00	0.30	24.93
1.00	100.00	0.19	19.96

From graph: K-value = 43.45 mg/g



K-Value Calculation for Test No. 154

Test No. 155

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 700^0 C, 60 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.91

$$\text{R value (\%)} = 100*(9.98 - 5.91)/9.98$$
$$= 40.9$$

Test No. 156

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700° C, 20 minutes, with moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

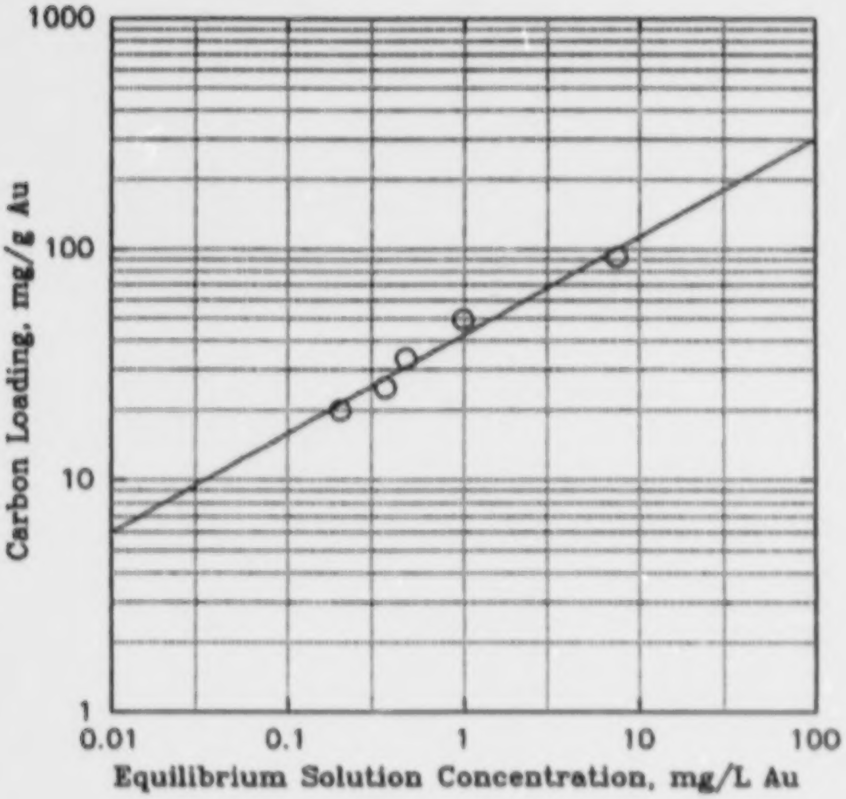
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.41	92.59
0.40	100.00	0.98	49.51
0.60	100.00	0.47	33.18
0.80	100.00	0.36	24.91
1.00	100.00	0.20	19.96

From graph: K-value = 42.46 mg/g



K–Value Calculation for Test No. 156

Test No. 157

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 700° C, 20 minutes. With moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.12

$$\text{R value (\%)} = 100*(9.98 - 6.12)/9.98$$
$$= 38.8$$

Test No. 158

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700° C, 40 minutes, with moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

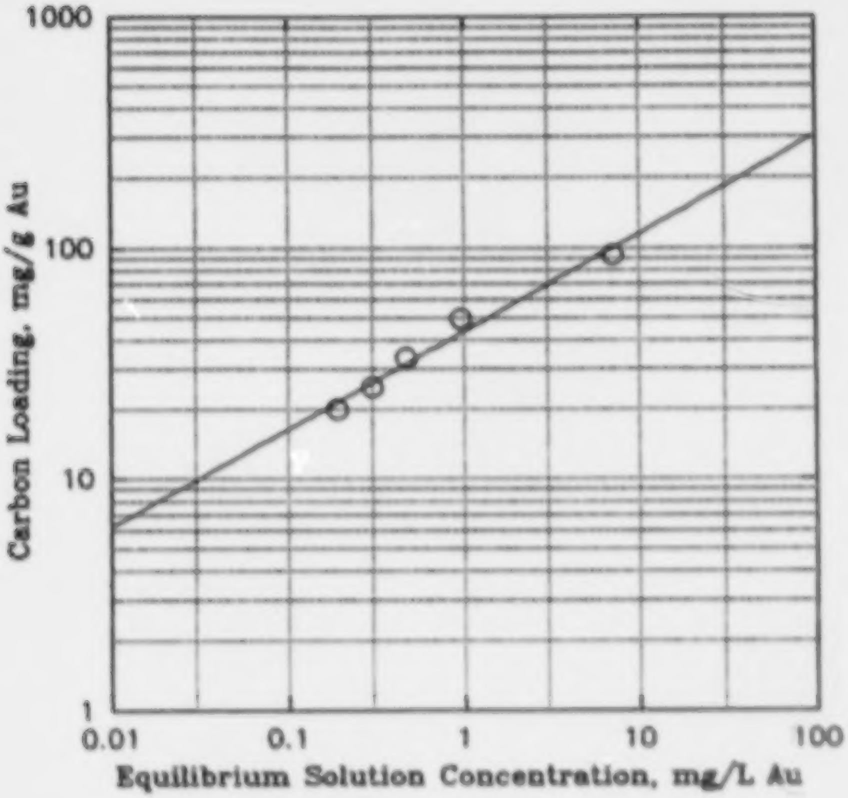
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.10	92.90
0.40	100.00	0.96	49.52
0.60	100.00	0.47	33.18
0.80	100.00	0.30	24.93
1.00	100.00	0.19	19.96

From graph: K-value = 43.55 mg/g



K-Value Calculation for Test No. 158

Test No. 159

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 700° C, 40 minutes. With moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.01

R value (%) = 100*(9.98 - 6.01)/9.98
= 39.9

Test No. 160

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700° C, 60 minutes, with moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

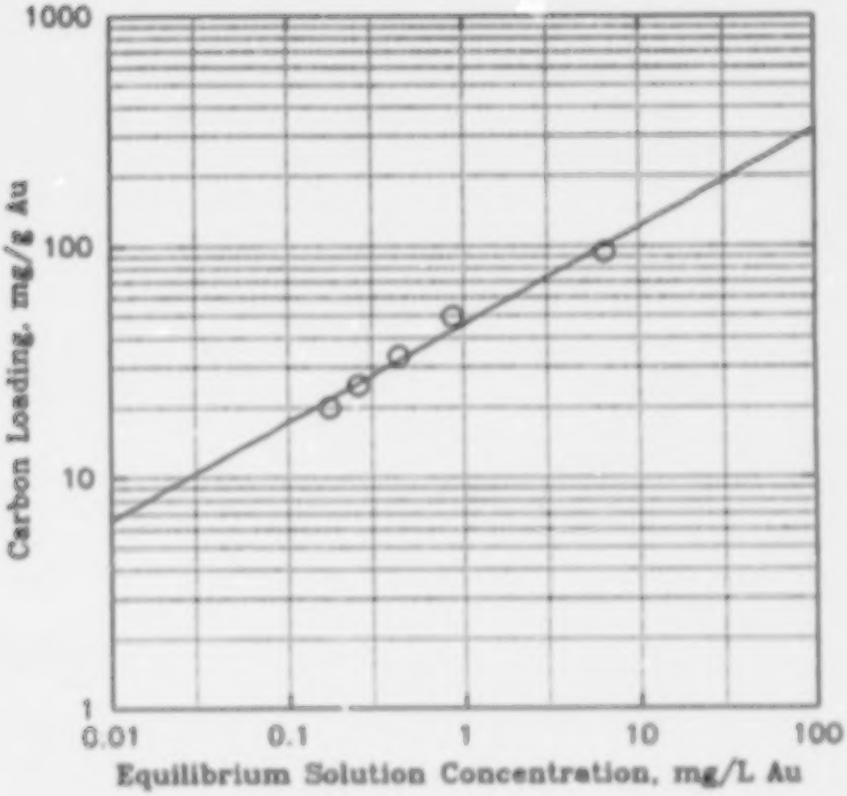
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.38	93.62
0.40	100.00	0.87	49.57
0.60	100.00	0.43	33.19
0.80	100.00	0.25	24.94
1.00	100.00	0.17	19.97

From graph: K-value = 45.81 mg/g



K-Value Calculation for Test No. 160

Test No. 161

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon regenerated at 700° C, 60 minutes. With moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.87

R value (%) = 100*(9.98 - 5.87)/9.98
= 41.3

Test No. 162

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 700° C, 40 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

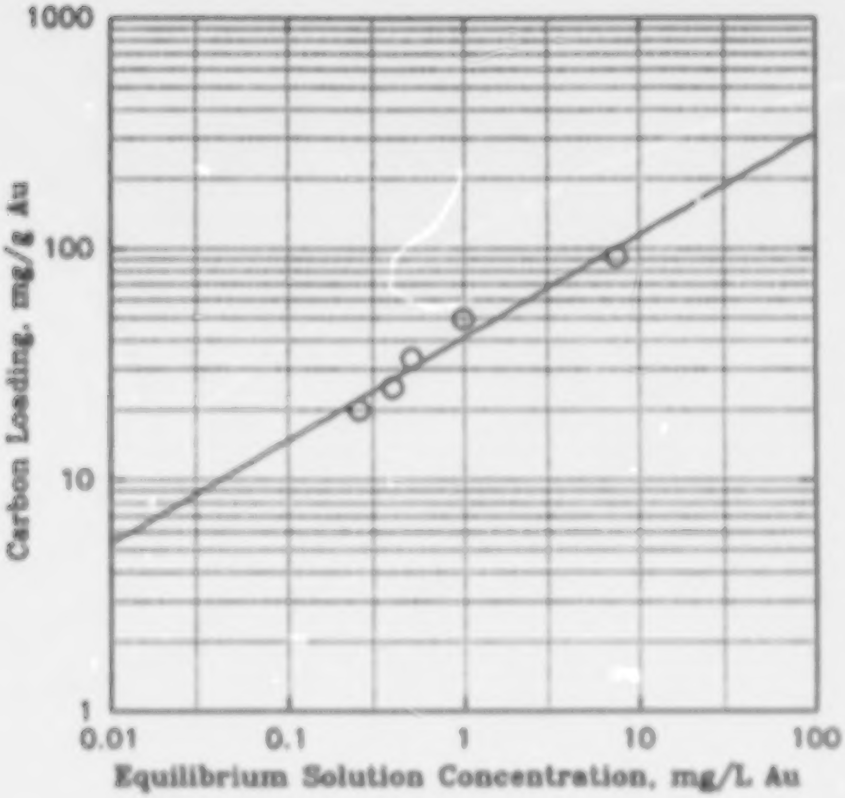
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.44	92.56
0.40	100.00	0.99	49.51
0.60	100.00	0.50	33.17
0.80	100.00	0.39	24.90
1.00	100.00	0.25	19.95

From graph: K-value = 41.21 mg/g



K-Value Calculation for Test No. 162

Test No. 163

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution without acid wash.

Sample: Test No. 69 carbon regenerated at 700° C, 40 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(2) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.22

R value (%) = 100*(9.98 - 6.22)/9.98
= 37.8

Test No. 164

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated second time at 700° C, 20 minutes, without moisture. (Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au. pH = 1.51

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

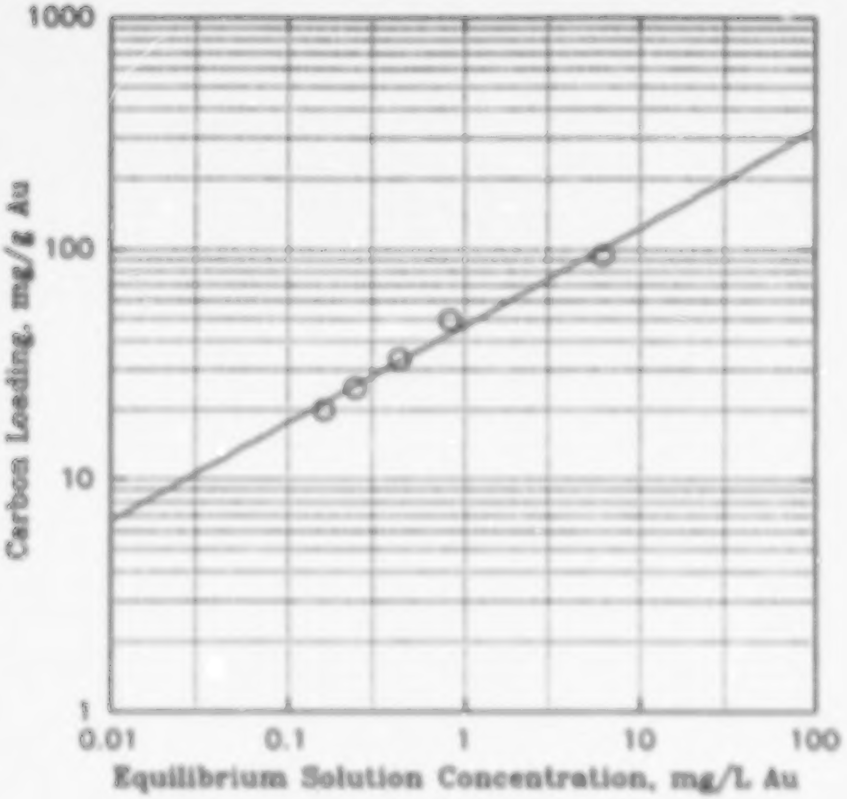
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.13	93.87
0.40	100.00	0.82	49.59
0.60	100.00	0.43	33.19
0.80	100.00	0.24	24.94
1.00	100.00	0.16	19.97

From graph: K-value = 46.67 mg/g



K-Value Calculation for Test No. 164

Test No. 165

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution without acid wash.

Sample: Test No. 69 carbon regenerated two times at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(2) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.82

R value (%) = 100*(9.98 - 5.82)/9.98
= 41.8

Test No. 166

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated third time at 700° C, 20 minutes, without moisture. (Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au. pH = 1.51

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

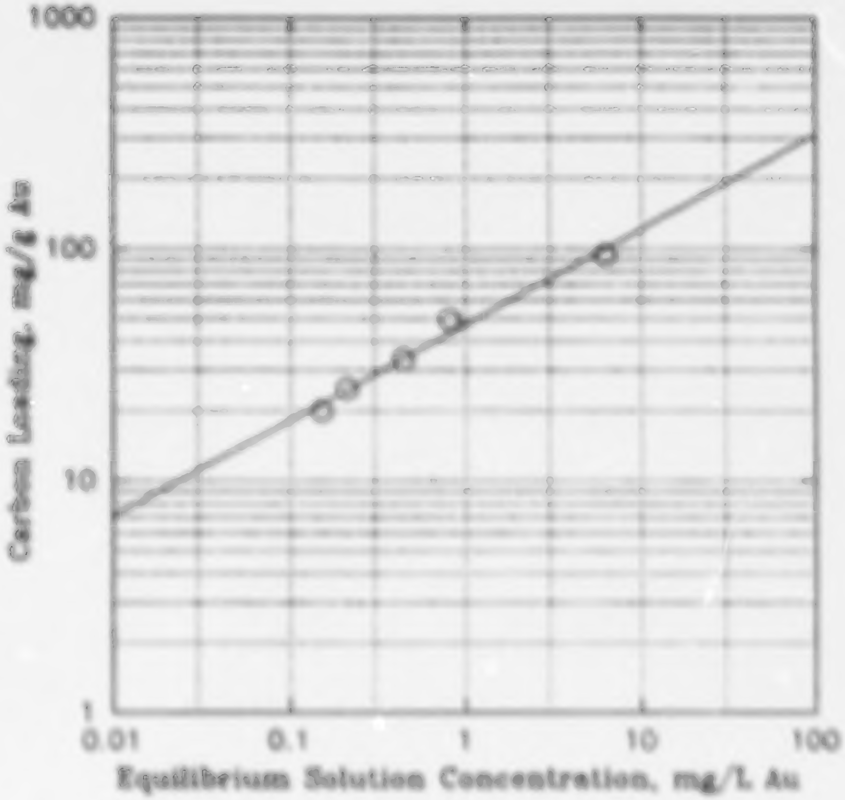
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.21	93.79
0.40	100.00	0.81	49.60
0.60	100.00	0.44	33.19
0.80	100.00	0.21	24.95
1.00	100.00	0.15	19.97

From graph: K-value = 46.99 mg/g



K-Value Calculation for Test No. 166

Test No. 167

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution without acid wash.

Sample: Test No. 69 carbon regenerated three times at 700^{0} C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(2) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	5.72

$$R \text{ value } (\%) = 100*(9.98 - 5.72)/9.98$$
$$= 42.8$$

Test No. 168

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 69 eluted carbon regenerated at 500° C, 40 minutes, without moisture.
(Elution with 50 g/L thiourea, 50 g/L H_2SO_4, 5% butanol, at 60° C).

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

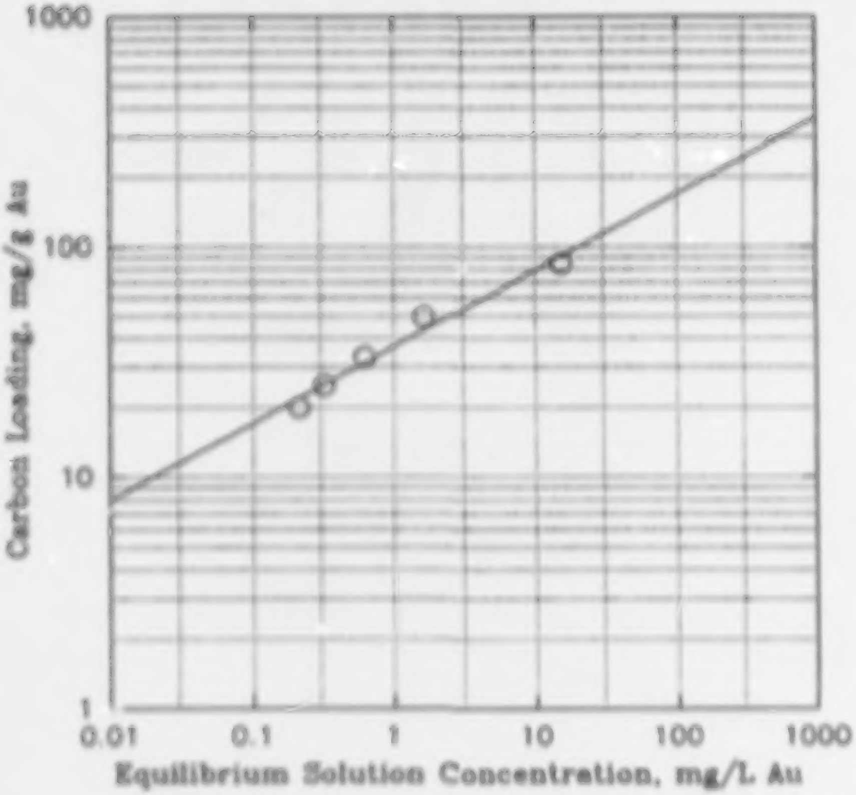
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	15.34	84.66
0.40	100.00	1.65	49.18
0.60	100.00	0.62	33.13
0.80	100.00	0.32	24.92
1.00	100.00	0.21	19.96

From graph: K-value = 36.81 mg/g



K-Value Calculation for Test No. 168

Test No. 169

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 69 carbon first regenerated at 500° C, 40 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.47

$$\text{R value (\%)} = 100*(9.98 - 6.47)/9.98$$
$$= 35.3$$

Test No. 170

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 124 eluted five times with Na_2S solution and first regenerated at 700^0 C for 20 minutes.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.55

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105^0 C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

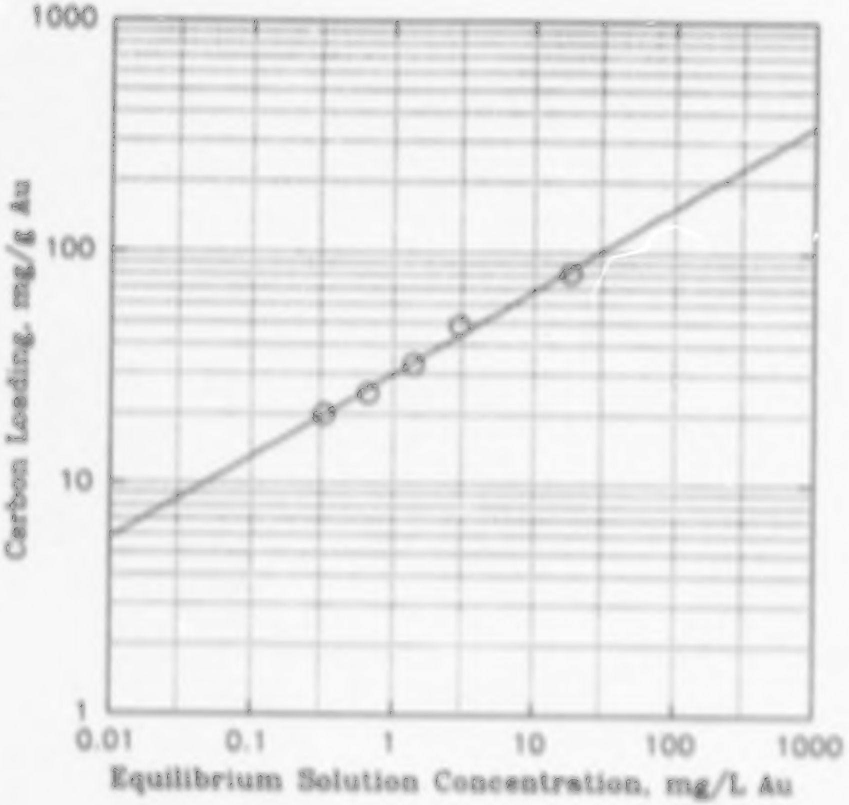
where
X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	18.47	81.53
0.40	100.00	2.93	48.54
0.60	100.00	1.38	32.87
0.80	100.00	0.66	24.84
1.00	100.00	0.32	19.94

From graph: K-value = 29.92 mg/g



K-Value Calculation for Test No. 170

Test No. 171

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 124 carbon first regenerated at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	7.18

R value (%) = 100*(9.99 - 7.18)/9.99
= 28.2

Test No. 172

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 124 eluted five times with Na_2S solution and second regenerated at 700° C for 20 minutes.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.55

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

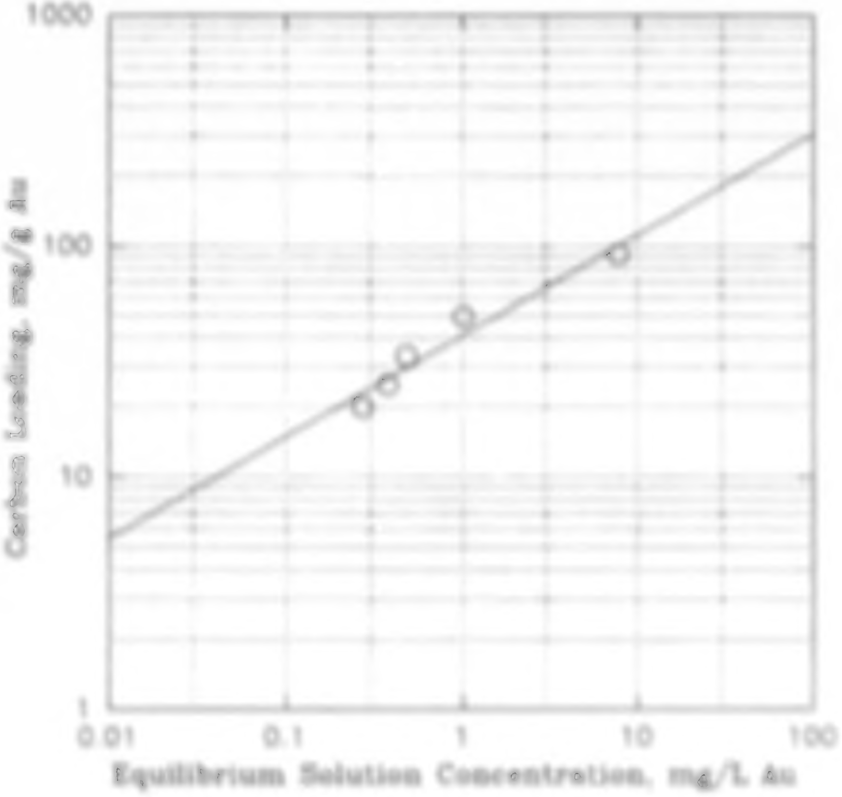
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.83	92.17
0.40	100.00	1.01	49.50
0.60	100.00	0.48	33.17
0.80	100.00	0.38	24.91
1.00	100.00	0.27	19.95

From graph: K-value = 40.83 mg/g



K-Value Calculation for Test No. 172

Test No. 173

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 124 carbon eluted five cycles with Na_2S and second regenerated at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	7.03

R value (%) = 100*(9.99 - 7.03)/9.99
= 29.7

Test No. 174

__Purpose:__ To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

__Sample:__ Test No. 124 eluted five times with Na_2S solution and third regenerated at 700° C for 20 minutes.

__Solution:__ Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

__Procedure:__

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 44 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

__Calculation:__

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

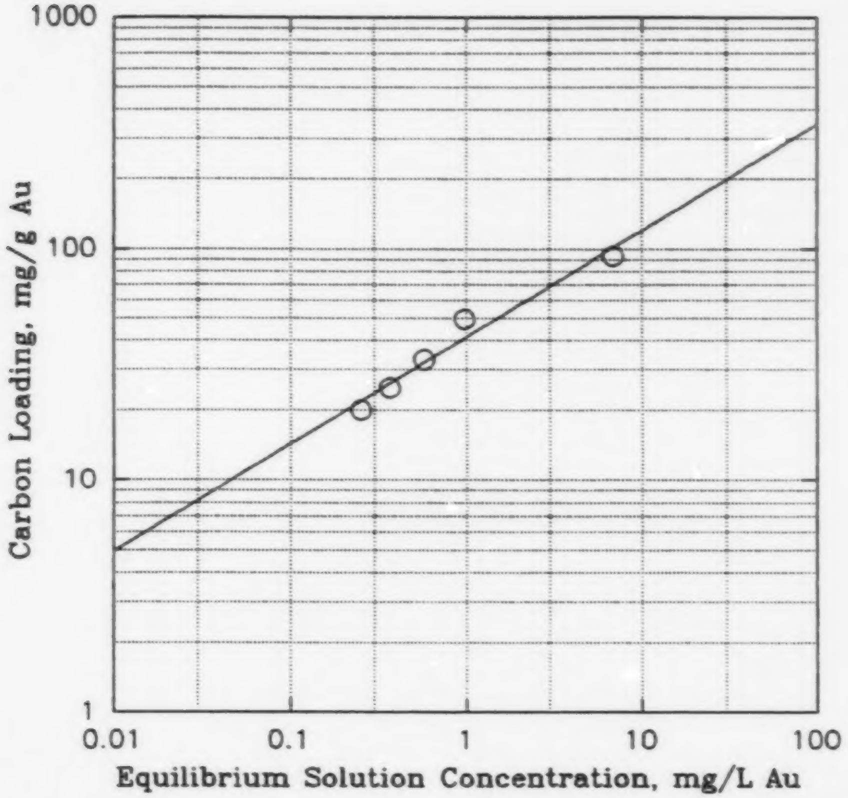
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot is the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	6.87	93.13
0.40	100.00	0.97	49.52
0.60	100.00	0.58	33.14
0.80	100.00	0.37	24.91
1.00	100.00	0.25	19.95

From graph: K-value = 41.40 mg/g



K–Value Calculation for Test No. 174

Test No. 175

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 124 carbon eluted five cycles with Na_2S and third regenerated at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value (\%)} = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	6.86

R value (%) = 100*(9.99 - 6.86)/9.99
= 31.4

Test No. 176

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 132 eluted five times with NaCN-NaOH and first regenerated at 700° C for 20 minutes.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.52

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and [illegible] the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

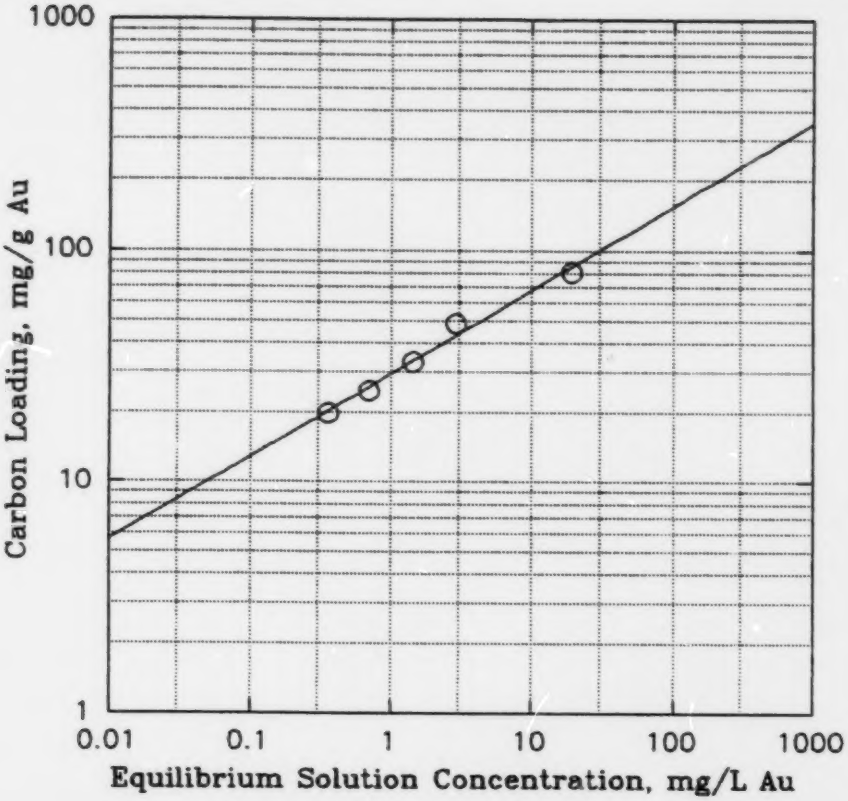
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	19.13	80.87
0.40	100.00	2.85	48.58
0.60	100.00	1.42	32.86
0.80	100.00	0.69	24.83
1.00	100.00	0.35	19.93

From graph: K-value = 29.51 mg/g



K–Value Calculation for Test No. 176

Test No. 177

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 132 carbon eluted five cycles with NaCN-NaOH and first regenerated at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au. pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	7.30

R value (%) = 100*(9.99 - 7.30)/9.99
= 27.0

Test No. 178

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 132 eluted five times with NaCN-NaOH and second regenerated at 700^0 C for 20 minutes.

Solution: Gold thiourea solution contained 100 mg/L Au.
pH = 1.51

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105^0 C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

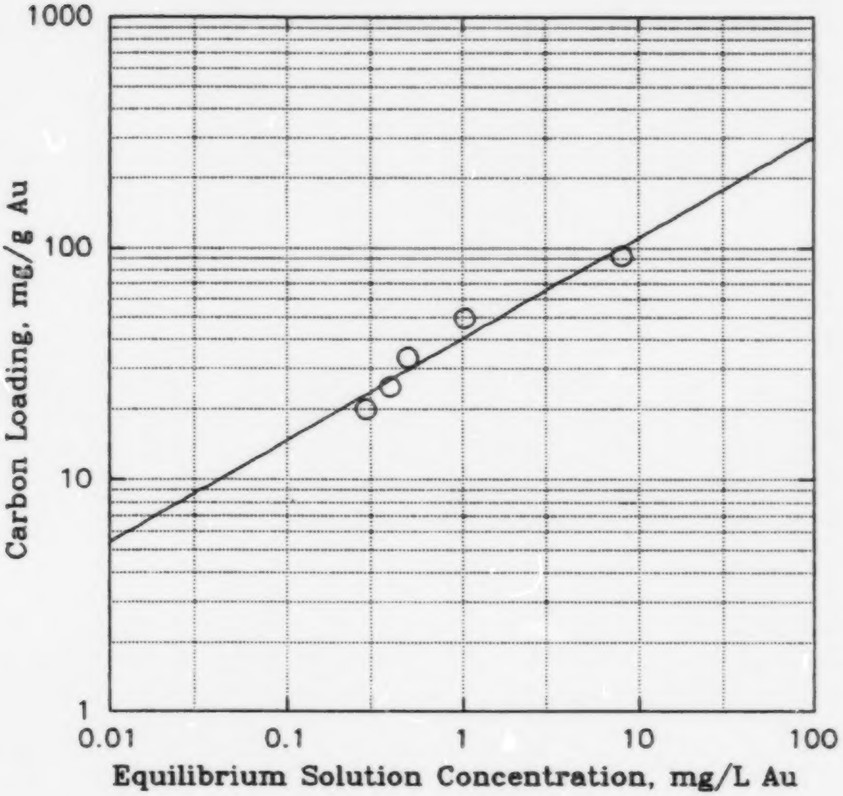
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	8.01	91.99
0.40	100.00	1.02	49.49
0.60	100.00	0.49	33.17
0.80	100.00	0.39	24.90
1.00	100.00	0.28	19.94

From graph: K-value = 40.36 mg/g



K–Value Calculation for Test No. 178

Test No. 179

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 132 carbon eluted five cycles with NaCN-NaOH and second regenerated at 700° C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105° C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$\text{R value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.99	7.06

R value (%) = 100*(9.99 - 7.06)/9.99
= 29.4

Test No. 180

Purpose: To determine the K-value (loading capacity) of a regenerated carbon from gold thiourea solution.

Sample: Test No. 132 eluted five times with NaCN-NaOH and third regenerated at 700° C for 20 minutes.

Solution: Gold thiourea solution contained 100 mg/L Au. pH = 1.51

Procedure:

(1) Soak 100 grams carbon sample with 200 ml 3% HCl solution in a 400 ml beaker. Boil for 10 minutes. Decant the acid solution and wash the carbon with water till the pH about 7. Dry at 105° C to constant mass. Cool in a desiccator.

(2) Accurately measure 0.2000, 0.4000, 0.6000, 0.8000, and 1.0000 of the sample and transfer to a 1 little bottle.

(3) To each bottle, add 200 ml of gold thiourea solution. Commence stirring on rolls at 46 rpm for 20 hours.

(4) Filter the content of each bottle through a Whatman No. 542 filter paper. Determine the equilibrium concentration of gold in each solution by Atomic Absorption Spectrophotometer.

Calculation:

To determine the gold adsorption capacity of the activated carbon use the Freundlich adsorption isotherm

$$\log (X/M) = \log (KC)$$

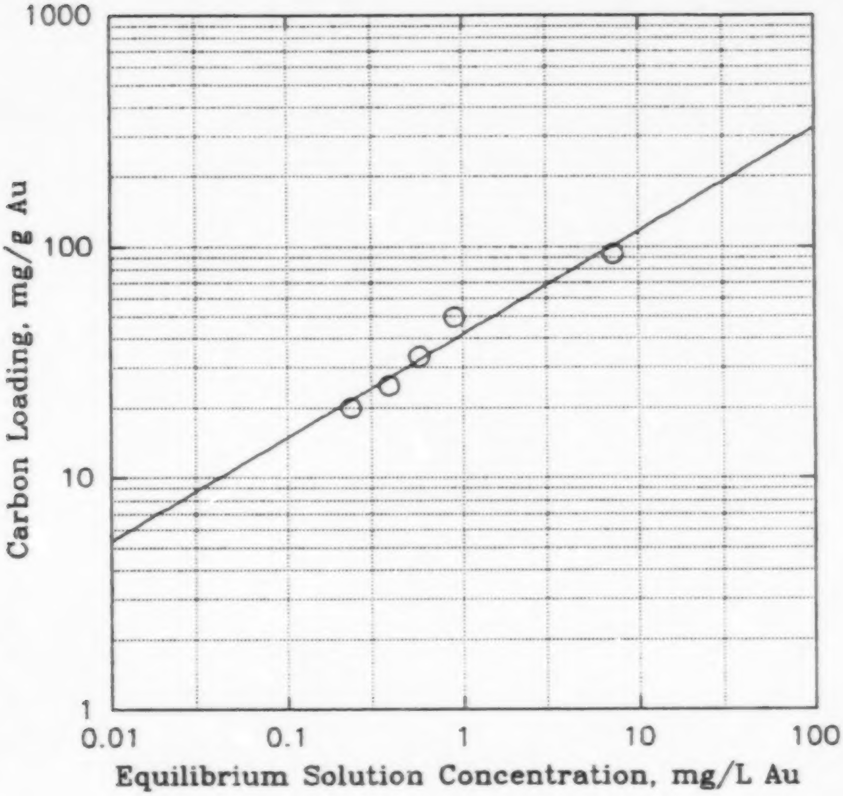
where X is the mass of gold adsorbed on the carbon (mg).
M is the mass of carbon.
C is the equilibrium gold concentration in the filtrate (mg/L).
K is the constant.

The (X/M) value at 1 mg/L equilibrium concentration determined from the isotherm plot in the K-value (loading capacity).

Results:

Carbon grams (M)	Solution, mg/L Au		Carbon Loading mg/g Au (X/M)
	Initial	Equilibrium, C	
0.20	100.00	7.18	92.82
0.40	100.00	0.89	49.56
0.60	100.00	0.56	33.15
0.80	100.00	0.38	24.91
1.00	100.00	0.23	19.95

From graph: K-value = 41.40 mg/g



K–Value Calculation for Test No. 180

Test No. 181

Purpose: To determine the R-value (gold adsorption rate) of a carbon sample adsorbed from a gold thiourea solution.

Sample: Test No. 132 carbon eluted five cycles with NaCN-NaOH and third regenerated at 700^0 C, 20 minutes. Without moisture.

Solution: Gold thiourea solution contained 10 mg/L Au.
pH = 1.55.

Procedure:

(1) Soak carbon sample in a 3% HCl solution and boil for 20 minutes. Decant and wash with water till pH=7. Dry at 105^0 C to constant mass and cool in a desiccator.

(2) Accurately measure 1.0000 gram of dry carbon to a 2 litre bottle. Add 1 L 10 mg/L gold thiourea solution and agitate on rolls at 46 rpm.

(3) Withdraw 5 ml aliquot after 0, 15, 30, 45, 60, 75 and 90 minutes. Determine gold value by Atomic Absorption Spectrophotometer.

Calculation:

Calculate, in per cent, the quantity of gold adsorbed on the carbon at 60 minutes.

$$R \text{ value } (\%) = \frac{A - B}{A} \times 100$$

where A is the initial gold concentration and B is the gold concentration at time t (60 minutes).

Results:

Time (min.)	0	60
Solution (mg/L Au)	9.98	6.72

$$R \text{ value } (\%) = 100*(9.98 - 6.72)/9.98$$
$$= 32.8$$